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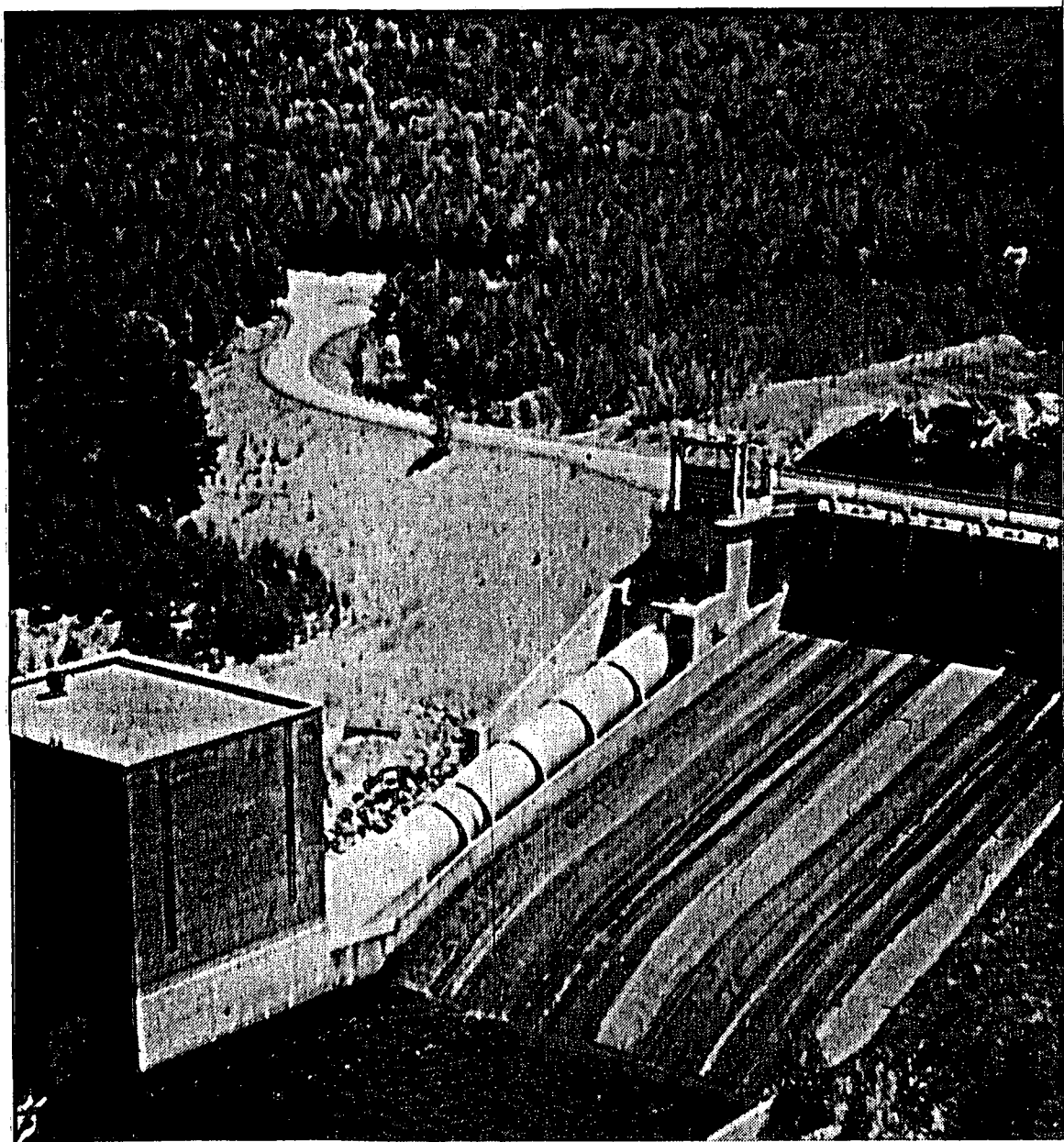
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International Science and Technology Institute, Inc.

REPORT ON THE POTENTIAL USE OF SMALL DAMS
TO PRODUCE POWER FOR LOW-INCOME COMMUNITIES



COVER PICTURE:

A TYPICAL SMALL SITE (2 MEGAWATTS) OWNED AND OPERATED BY A UTILITY. LOCATED ON THE HUDSON RIVER IN NEW YORK STATE, ALL PARTS OF A TYPICAL HYDRO SITE ARE VISIBLE HERE: THE DAM, PENSTOCK (PIPE), AND POWER HOUSE.



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REPORT ON THE POTENTIAL USE
OF SMALL DAMS TO PRODUCE POWER
FOR LOW-INCOME COMMUNITIES

SUBMITTED TO
THE COMMUNITY SERVICES ADMINISTRATION
ENERGY PROGRAM, CONTRACT NO. B8B-5584
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PREPARED BY
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PREFACE

This report was submitted to the Community Services Administration's Energy Program by the International Science and Technology Institute, Inc., in cooperation with the New York Polytechnic Institute, Center for Regional Technology. The Project Director, Mary M. Allen, gratefully acknowledges the expert assistance of Richard Napoli and Herbert Sherman of the Center for Regional Technology.

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EXECUTIVE SUMMARY

Introduction

The impacts of the rising cost of fossil fuels is felt most strongly by those least able to absorb higher prices -- low-income communities. One alternative energy source which would have a stable cost and alleviate this economic strain is the redevelopment of small dam sites which exist throughout the country to produce hydroelectric power.

Resource Assessment

Although official inventories and agency definitions are neither complete nor complimentary, there is a consensus that substantial small hydro potential does exist. The U.S. Army Corps of Engineers estimates that the undeveloped hydroelectric potential at existing dams with a capacity less than 5,000 kilowatts is 26,600 megawatts. This figure represents an equivalent saving of 139 million barrels of oil.

Hydropower potential from small dams exists throughout the country. In order to assess the specific benefits which could accrue to any one low-income community, however, site-specific information about both the dam and the community is necessary.

Current Governmental Programs

Congress appropriated \$10 million for FY 1978 for a DOE small hydro program consisting of feasibility studies, demonstration projects and studies on environmental, economic and institutional issues. The National Energy Act contains provisions for a loan program for feasibility studies as well as for construction costs. The Federal Energy Regulatory Commission is working to simplify licensing procedures for small hydro developers and has issued a "short form" license for small projects.

New inventories, as well as other studies on technical, economic and institutional issues, are being undertaken by both the U.S. Army Corps of Engineers and the Bureau of Reclamation. Programs have also been initiated in several Northeastern States.

Environment and Safety Considerations

There is fairly widespread agreement among governmental and environmental representatives that the rehabilitation of existing small dam sites poses little or no threat to the environment. Fish passage facilities may have to be constructed in some instances, however.

Institutional Barriers to Small Scale Hydropower Development

Utility company opposition to "outside" developers of small hydro sites could be an important impediment. Licensing procedures and other regulatory requirements also result in delays and additional expense for small hydro developers although the FERC is attempting to speed up the process.

Other issues which may impede small hydro development include: the unavailability of liability insurance; dams used for other purposes (such as irrigation, recreation or flood control) which may preclude their use to produce hydropower; and problems in ascertaining ownership of dam sites.

Economic Considerations

Mixing hydropower with other technologies to form "energy systems" will reap the greatest utility from small hydropower sites. Total reliance on decentralized small-scale hydropower may or may not be enough for a local community or industry. In either case, however, scarce fossil fuels will be replaced by renewable energy sources.

The economic feasibility of utilizing small scale hydropower for any community is very dependent on the specific site in question. Up-front costs for feasibility studies and licensing represent the most difficult financial constraint. In terms of available capital, CSA and local community development agencies, with their access to special funds, may have a distinct advantage in the redevelopment of small-scale hydropower.

Community Services Administration's Program Options

Based on the findings of this report, program options for CSA fall into two basic categories: support for ongoing programs and CSA action items. It is recommended that CSA support:

- ° Congressional initiatives on grant and loan programs and regulatory reform;
- ° Interagency cooperation in order to target small hydro programs to low-income communities;
- ° Regulatory streamlining within the FERC to simplify and expedite license applications for small hydro developments beyond present short-form limit of 1500 KW.

There are several ways CSA can contribute to the development of small

- ° Set up an information program to inform low-income communities, through CAAs, of Federally-supported programs on small hydro and encourage them to participate in such programs;
- ° Financially support feasibility studies for those low-income communities which are responding to Federal programs;
- ° Seek to actually fund, perhaps in conjunction with HUD or the Department of Commerce's Economic Development Administration, a small hydro facility in a low-income community.

I. - INTRODUCTION

In order to understand the complex set of issues at play in the development of small-scale hydropower, it is important to have a rudimentary knowledge of what hydropower is. According to the U.S. Army Corps of Engineers:

Hydropower is generated through the propulsion of electrical generators employing the natural energy inherent in the gravitational flow of water. Thus, it is a finite resource whose ultimate potential is determined by the magnitude and seasonal variation of the water runoff of the major drainage basins of the country, and the physical configuration of the surface area.

The potential supply of hydropower, then, is dependent on certain physical characteristics of the country as well as on technology. This report will address the former issue in a limited way by reviewing the resource assessments which have been done in order to estimate the potential contribution of hydropower to the nation's energy supply. The question of technology and the "state-of-the-art" in hydropower generation will also be addressed (See Sections I and II below).

For the purposes of the Community Services Administration (CSA), however, other considerations such as environmental and institutional constraints, economic issues and current Federal programs may be even more important. This report will address all of these issues in an attempt to arrive at program recommendations for CSA. Before beginning that analysis, however, this introduction will present a brief history of the development of hydropower in the United States, an explanation of why there has been a recent upsurge in activity in developing small hydro sites, and a rationale for possible CSA involvement in this area.

History of U.S. Hydropower

The United States during the late 18th century and early 1900's was using water power via mechanical devices (waterwheels - flutter wheel, impact wheel, breast wheel, and undershot wheel) for such industries as knitting, wood cutting, tanners, and so forth. These devices flourished in the Northeast during America's industrial revolution and played a key role in the development of Northeast industry by supplying a cheap source of power. Turbine technology entered the United States in approximately 1835 in Pennsylvania via Elwood Morris, who built and operated two wheels and later published the results of his experiments on them in 1843. In 1844 Uriah A. Boyden designed a 75 horsepower (h.p.) unit, the Founneyron turbine, and in 1846 produced a 190 horsepower unit with 75% efficiency. By the 1870's however, water turbines replaced

the wheel for two reasons: a) greater efficiency, and b) smallness of unit. Lowell, Massachusetts had 70 turbines in use with a total production of 10,000 h.p., the largest unit having a 675 h.p. capacity.

By the end of the 19th century impulse turbines were developed which could accommodate heads of over 800 feet, leading the United States to the development of high head dams. In 1886 an International Commission was formed to fully exploit the hydroelectric potential of Niagara Falls and an installation of 25 units producing 5000 h.p. each at a 136 foot head was agreed upon. Perhaps the most fitting end to the 19th century history of water power came in 1896 when the "Niagara of Water Wheels" in Troy, N.Y. (278 h.p.) was replaced by a Jonval turbine.

The entire Northeast was once the center of American industry based on the availability of a plentiful supply of inexpensive hydropower. The hundreds of mill towns found in this area attest to their once booming economies. As the machines of the industrial revolution increased in speed and reliability, the need for a concentrated and completely reliable source of energy was required. The discoveries of coal, iron ore and eventually oil in the Mid-West and South sounded the death knell of the Northern factories based on water power.

Not all factories in the Northeast became obsolete. Many whose water sites proved adequate were able to convert to hydroelectricity. Other hydro sites were developed by newly-formed electric companies to provide power to the mills as well as the surrounding communities. The boom that built the original mills reached its peak in about 1880 and by 1910, it was over. Those that could convert to electric generation did so and the others either moved West or closed down.

From 1910 to 1930 was the era of big hydropower with the Boulder Dam, Hoover Dam, Bonneville Dam and the Tennessee Valley Authority dam wheeling multi-megawatt capacities. Most of the bigger dams were Federally owned and operated. At the same time turbine technology had made a quantum leap to crossflow, Kaplan (tube) turbines which had, at under a 9 foot head, a maximum 86% efficiency. This led to a rebirth of hydropower installations with low heads starting in the late 1930's and ending in the late 1950's.

Cheap fossil fuels in the 1960's caused many utilities and industries to shut off or abandon their hydropower plants as well as deter possible construction of new ones. It was not until the 1973-1974 energy crunch that anyone seriously reconsidered alternative energies such as low-head hydropower and a second rebirth of this technology is now underway.

Federal Involvement in Hydropower

Along with the physical and economic development of this resource is the development of Federal involvement in and regulation of hydropower. The U.S. Army Corps of Engineers issued a report on hydroelectric power potential at Corps' projects² in which the evolution of public policies affecting hydropower development is summarized. The report noted that upon reviewing publications³ which list Federal involvement:

One emerges....with an impression of a highly complex set of Federal policies, controls, regulations, organizations and objectives which have evolved over the years in response to changing needs, circumstances and pressures.⁴

In general, the development of Federal policy can be categorized in four phases.⁵ In the late 19th century Congress recognized the need to control the private development of hydropower on navigable streams to ensure that such development was in the public interest. The consent of Congress was required for the construction of any "bridge, dam, dike or causeway over or in any port, roadstead, haven, harbor, canal, navigable river, or other navigable water" under the authority granted Congress by the Interstate and Foreign Commerce clauses of the U.S. Constitution.⁶ Any plans for such construction had to be submitted to and approved by the Chief of Engineers and the Secretary of War. The Federal Power Commission was subsequently granted the authority to issue licenses to citizens, corporations, states or municipalities for the construction, operation and maintenance of dams, reservoirs, powerhouses, and transmission lines.

The second period in the development of Federal policy encompasses the years of 1900 to 1921 when basic principles for private development of water resources were evolved. Rather than the narrow definition of "public interest" found in the Interstate and Foreign Commerce clauses of the Constitution, water power was seen in this period as a permanent asset to be utilized for the benefit of the people of the nation. In their attempts to insure that the control of water power did not lead to "unequalled opportunity for monopolistic control of industries and monopolistic control of the daily life of our people in an unprecedented degree"⁷ Presidential vetoes and Congressional opposition effectively slowed private development. Passage of the Federal Water Power Act in 1920 embodied the principles of government control through licensing and broke the deadlock.

This period was followed by the third period encompassing the 1920's to the 1940's. The initiation of the Federal role in the development and operation of hydropower facilities and the sale of hydropower occurred during this time. Relevant laws which established this role include:

- ° Boulder Canyon Act of 1928
- ° Tennessee Valley Authority Act of 1933
- ° Public Utility Act of 1935
- ° Bonneville Act of 1937
- ° Flood Control Acts of 1936, 1938 and 1944
- ° Amendments to the Federal Power Act

Finally, the 1960's and 1970's saw a series of national policy measures designed to integrate all water resources activity into a comprehensive plan of resource development and conservation. To this end, the following legislation was enacted:

- ° Wilderness Act of 1964
- ° Water Resources Planning Act of 1965
- ° Wild and Scenic Rivers Act of 1968
- ° National Environmental Policy Act of 1969

This is admittedly a very brief review of Federal involvement in hydropower development. A more in-depth treatment of the subject can be found in the Chapter on "Public Policy Affecting Hydropower Development" of the Army Corps of Engineers' report cited above.

Recent Interest in Small Hydro

As noted above, emphasis in the past few decades in the construction of dams to produce hydroelectric power has been on very large structures to produce a vast amount of electricity for huge, centralized, regional transmission systems. These systems, along with thermal generating facilities using oil, gas or coal, could produce electricity economically for the largest number of consumers. The obvious question is why the recurrence of interest in small hydroelectric facilities has blossomed, not only at the Federal level, but at state and local levels as well.

The equally obvious answer, of course, is the astronomical leap in oil and gas prices since the 1973 Arab oil embargo. Coupled with this are increasing pressures from environmentalists leading to regulations of the coal industry and large hydroelectric, as well as nuclear and thermal, power plants. Fears of diminishing reserves of the fossil fuels, which replaced the small hydropower facilities in the early part of the century, have fostered plans for a national energy policy emphasizing both conservation and the development of new sources of energy.

Paralleling the renewed interest in power from the sun and wind is the resurgence of activity in generating power from flowing water. Hydropower as an alternate energy source is renewable, non-polluting and can be decentralized. Smaller dams face little or no opposition on the basis

of environmental considerations -- a factor making them particularly attractive. Utilizing water, as a renewable resource, also fits conservation criteria. The Federal Energy Regulatory Commission estimates that the undeveloped hydroelectric potential at existing dams with a capacity less than 5,000 KW is 26.6 GW (26,600 megawatts). This figure represents an equivalent saving of 139 million barrels of oil.⁸

More important, however, are economic factors. Especially in New England, the Northwestern part of the United States and the Appalachian states (where the need is the greatest and mountain streams abound) electricity generated at small hydro sites may be economically competitive with other sources of electricity.

On April 20, 1977 President Carter submitted his comprehensive energy plan to Congress. Small hydropower development was specifically addressed:

New or additional hydroelectric generating capacity at existing dams could be installed at less than the cost of equivalent new coal or nuclear capacity. Many of these sites are small, but could generate 3 to 5 megawatts, and are located near major demand centers currently dependent on imported fuel oil. Installation of additional generating capacity at existing sites could conceivably add as much as 14,000 megawatts to the nation's generating potential.

The accompanying fact sheet stated that the President had directed the Corps of Engineers to report on the potential for additional hydropower installations at existing dams throughout the country -- especially at small sites. The U.S. Army Corps of Engineers' Institute for Water Resources prepared a 90-day study entitled Estimate of National Hydroelectric Power Potential at Existing Dams. The study, which included large and small dams, concluded that the potential hydroelectric capacity at all existing dams was 54,600 MG -- equivalent to the capacity of 55 nuclear power plants. In addition, the study described constraints which inhibit the full development of hydropower at existing dams and contained recommendations for further Federal action.

Federal interest in small hydro received an impetus from another source: the collapse of the Teton Dam. At the urging of Senator Frank Church of Idaho, \$1.6 million in FY 1977 funds were reprogrammed late in the fiscal year to set up small demonstration plants at the three dams at Idaho Falls which were damaged as a result of the collapse of the Teton Dam. Meanwhile, Congress appropriated \$10 million to set up a small hydro program in the Department of Energy.

In September 1977, DOE sponsored a seminar on small hydropower at Durham, New Hampshire. Two other similar seminars were sponsored at

Lansing, Michigan and Idaho Falls, Idaho. DOE's program, which includes studies on institutional and economic questions as well as feasibility studies and demonstration projects, is detailed in Section III of this report (see pages III-4 to III-8). For FY 1979, DOE's budget for this program will probably be \$15 million.

Along with DOE's program to encourage small hydro development, the Federal Energy Regulatory Commission is investigating ways to shorten the licensing procedure required for private developers of small hydro. The Federal construction agencies, the U.S. Army Corps of Engineers and the Bureau of Reclamation, are both initiating programs on hydroelectric power generation at small dam sites. Section III of this report presents descriptions of current programs at the Federal and state levels.

Impact of High-Cost Energy on Low-Income Communities

Low-income people would have much to gain from a source of energy whose cost could be guaranteed not to rise. The Federal Energy Administration's Household Energy Expenditure Model for 1973-1975 showed that households with less than \$3,400 in disposable income spent 10% of their income on electricity. On the other hand, households between \$10,500 and \$15,200 spent only 2% on electricity. Since those persons with low incomes use electricity primarily for essentials, they do not usually have the option of cutting back on their use of electricity in order to reduce their electricity bills. Therefore, if current projections of increased costs for fossil fuel are valid, the poor stand to suffer the most by higher electricity costs. Hydropower, as the one source of electricity which is immune to rising fuel costs, could be a significant factor in reducing electricity costs for those low-income communities located near hydro sites.

Several communities, especially in New England where the cost of electricity is extremely high and many old dams exist, are looking into the possibility of refitting existing dams to produce electrical power. The town of Nashua, New Hampshire, with Federal aid, plans to develop two dams to provide electricity for its high school, library, fire station, public works garage and some street lights. City officials are estimating that savings from just one of the dams could be more than \$100,000 a year.⁹

The town of Springfield, Vermont is planning to form a municipal utility, take back the electric power franchise from the Central Vermont Public Service Corporation, buy the latter's installations, and build a \$57 million, six-dam hydroelectric peaking-power system. As a consequence, they will save about 30 percent of their present outlay for electricity.¹⁰

The town of Turners Falls, Massachusetts is also attempting to "municipalize" in order to set up their own publically-owned utility. Hydro-

power could serve as a source of peaking-power for this system. It is believed that this move would "serve to control and rein in the cost of electricity." In Massachusetts, however, there are legal impediments to municipalizing in the form of 1929 legislation guaranteeing electric monopoly systems the right to maintain their systems unless they elect to sell.

In California, the United Water Conservation District has proposed to build a small hydroelectric generating plant at the foot of the Santa Felicia Dam on Lake Piru -- a recreational playground. The dam has a potential of producing 1,940 KW of power. The district plans to use this capacity to provide peaking-power to the Southern California Edison Company. According to a consultants' report prepared on the subject, the hydroelectric plant could put many of the 107 people of Santa Monica who lost their jobs at Rockwell International after cancellation of the B-1 bomber project back to work.¹¹

The district hopes to finance the project with state and Federal grants, including a \$350,000 Title IX Economic Adjustment grant for planning, engineering and specifications for the plant from the Department of Commerce, Economic Development Administration.

The importance of hydropower in being able to insure a source of electricity at stable prices, to produce energy or energy products which can be marketed, and to create jobs, would seem to indicate the necessity of insuring that the possible benefits of such development be targeted to those who stand to lose the most from higher energy prices: low-income communities. As will be seen in the report that follows, current Federal programs are based on other criteria and do not take the needs of the poor into account in planning their programs.

The Community Services Act of 1974 gives the Community Services Administration the authority to "establish procedures and take other appropriate action necessary to insure that the effects of the energy crisis on low-income persons, the elderly, and the near poor, are taken into account in the formulation and administration of programs related to the energy crisis."¹² Furthermore, the Director is authorized to provide financial and other assistance for,

...programs and activities, including, but not limited to, an energy conservation and education program...emergency loans, grants, and revolving funds to install energy conservation technologies and to deal with increased housing expenses relating to the energy crisis; alternative fuel supplies, special fuel voucher or stamp programs ... appropriate outreach efforts; furnishing personnel to act as co-ordinators, providing legal or technical assistance or otherwise representing the interest of the poor in efforts relating to the energy crisis...¹³

A viable program with regard to the potential of small hydroelectric generating plants for low income communities must be based on an understanding of the technical, economic, social, and political factors which will determine the feasibility of small hydropower. With that in mind, this report represents a summary of relevant issues for CSA to consider before embarking on a small hydro program.

Section II reviews resource assessments and available technology. Section III presents a summary of current Federal and State programs in small hydropower. Sections IV, V and VI deal with environmental impacts, institutional barriers, and economic factors of redeveloping small hydro facilities. Finally, Section VII contains recommendations to CSA for possible activity in this area.

FOOTNOTES

INTRODUCTION

¹U.S. Army Corps of Engineers, Institute for Water Resources, Hydroelectric Power Potential at Corps of Engineers Projects, IWR Research Report 75 R1 (July 1975), p. 1-1.

²Ibid.

³Federal Power Act, March 1, 1971 and Truman B. Price, Hydroelectric Power Policy, National Water Commission, Arlington, Virginia, February 1971.

⁴Corps of Engineers, July 1975, p. 11-1.

⁵The following section is based largely upon Chapter 11 of the Corps of Engineers' report cited above.

⁶Federal Power Act, March 1, 1971, River and Harbor Act of 1899, p. 61.

⁷Truman B. Price, Hydroelectric Power Policy, pp. 17-19.

⁸From a Federal Energy Regulatory Commission table by R.A. Corso (mimeo), 5/12/78.

⁹Alan P. Henry, "Unused N.E. Dams Seen As Electric Power Source," Boston Globe (March 12, 1978).

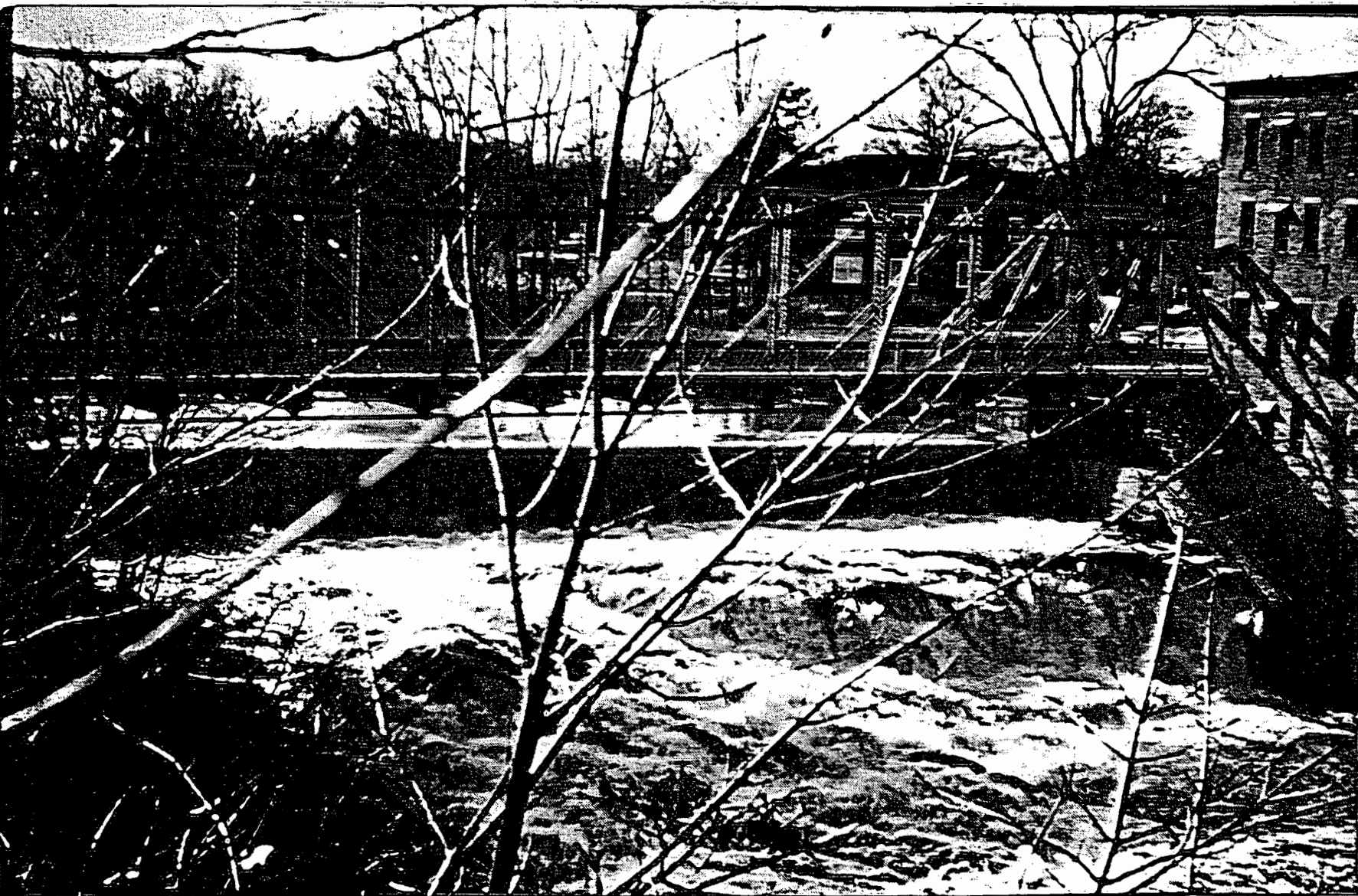
¹⁰Steve Turner, "Power to the People: The Contested Case of Springfield, Vermont," New England Magazine, The Boston Sunday Globe (July 9, 1978).

¹¹"Hydroelectric Power Plant Proposed at Lake Piru," Fillmore (California) Herald (January 19, 1978).

¹²Community Services Act of 1974, Section 222(a) 12.

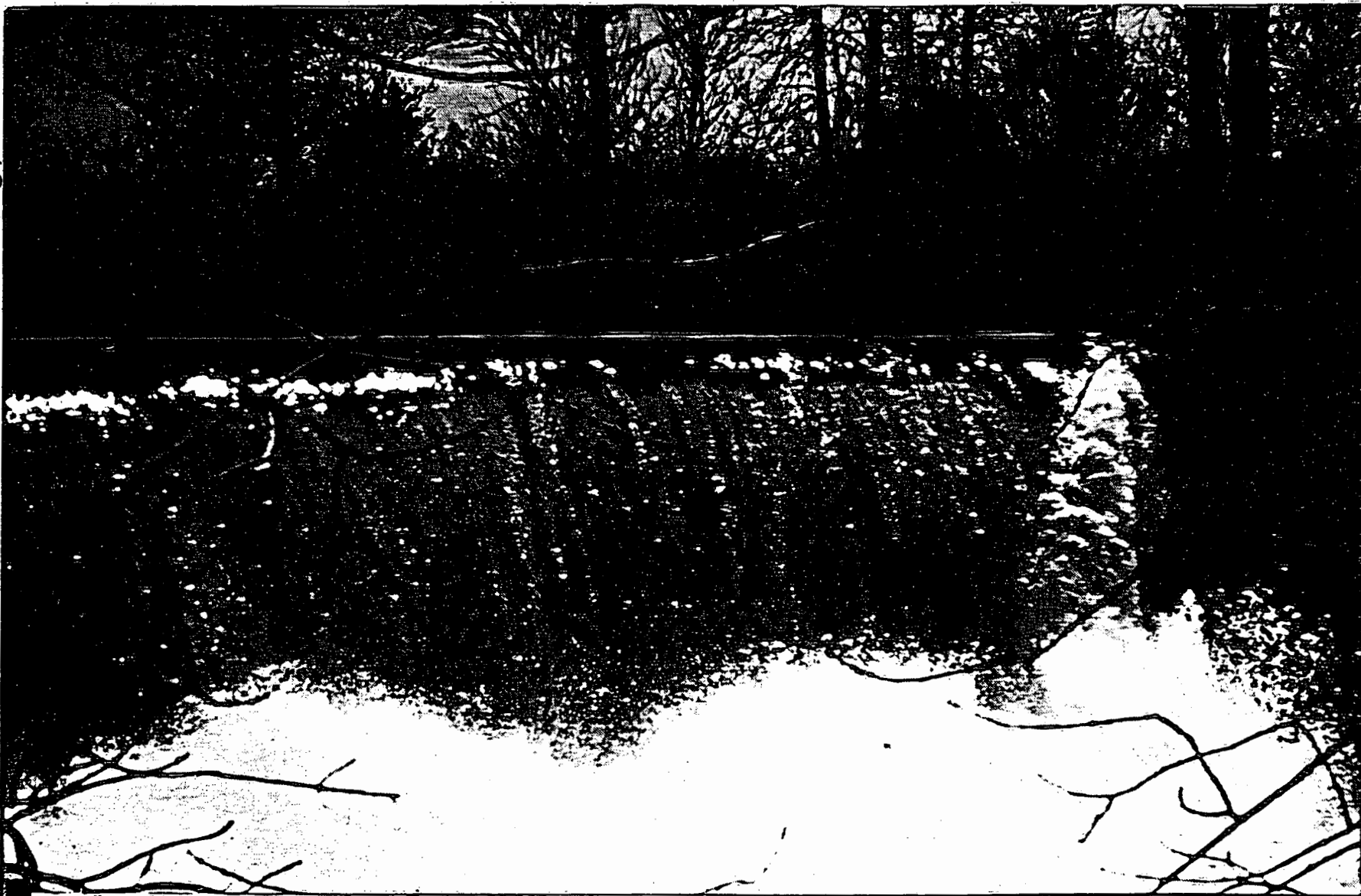
¹³Ibid.

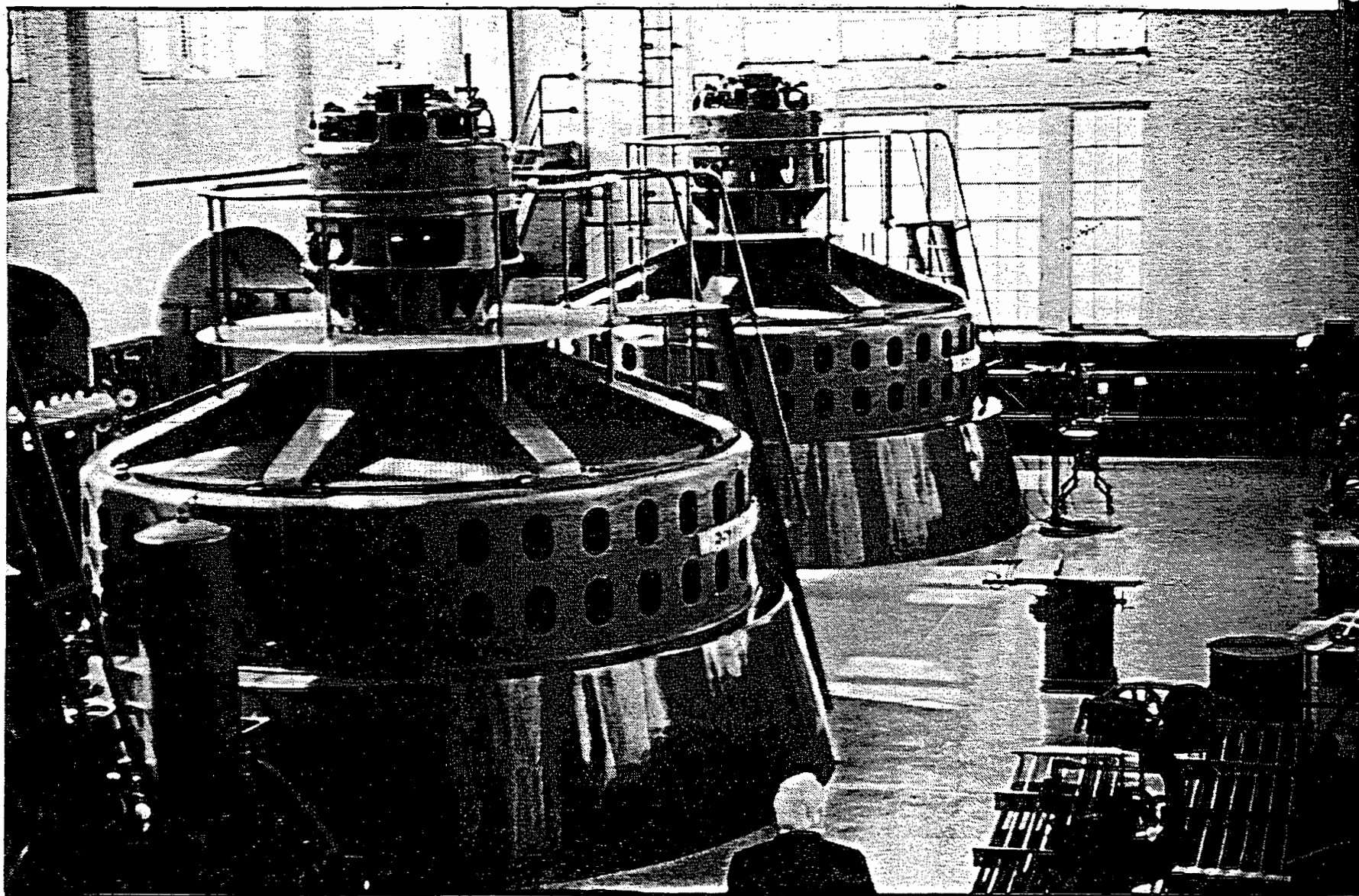
THIS SITE ONCE SUPPORTED TWO VERY LARGE FACTORIES. THE HEAD IS ABOUT 18 FEET IN HEIGHT AND WATER FLOWS THROUGH PENSTOCKS ON BOTH SIDES OF THE STREAM. FACTORIES WENT INTO PRODUCTION AT THE TURN OF THE CENTURY BUT HAVE NOT OPERATED SINCE 1940.





THIS 14-FOOT FALLS AT THE TANNERY ISLAND PAPER COMPANY IN WEST CARTHAGE, NEW YORK, HAS A CAPACITY OF 1500 KW. AT ONE TIME IT SUPPLIED FULL ELECTRIC POWER FOR A TANNERY, PLOW MANUFACTURER AND LATER, A PAPER MILL. IT WAS IN OPERATION AS RECENTLY AS 15 YEARS AGO.





WITH A CAPACITY OF 7000 KW AND A HEAD OF 23 FEET, THESE GENERATORS ARE LOCATED AT A SITE IN WATERTOWN, NEW YORK, ABOUT 20 MILES DOWNSTREAM FROM THE TANNERY ISLAND SITE. THIS MUNICIPALLY-OWNED SITE IS IN EXCELLENT CONDITION AND HAS BEEN IN CONTINUOUS OPERATION FOR THE PAST 55 YEARS.

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II. RESOURCE ASSESSMENT

The technology needed for small hydroelectric generating plants does exist -- and there have been few innovations in the past 50 years. A summary of the "state-of-the-art" of small hydro technology and a list of manufacturers appears in Appendix B.

The remainder of this section concentrates on parameters used to define "small hydro" in current Federal programs, explanations of official inventories and the problems in identifying potential sites, and finally, small hydro potential for low-income communities.

Parameters of Government Programs

Parallel to increasing interest in small hydro development, one finds a corresponding increase in the semantic confusion about what "small hydro" actually means. A brief review of the criteria utilized by the Federal agencies involved illustrates this fact. The rationale behind these differences should be explored in order to address the policy implications of adopting one set of parameters over another.

The Department of Energy, in its programs, defines small-scale hydropower as being a dam site with a head of 20 meters (approximately 66 feet) in height with a power production between 50 and 15,000 KW. These criteria have been applied both to the feasibility studies which were awarded in April 1978, and to the "Program Opportunity Notice" soliciting proposals for demonstration projects. As the primary Federal agency for funding small hydro projects, DOE's criteria have important implications for defining the parameters of future programs.

The Federal Energy Regulatory Commission (FERC) is attempting to streamline the licensing procedure for potential developers of small hydro sites. Because of various legislative restrictions such as the National Dam Inspection Act, the Fish and Wildlife Coordination Act and the Federal Power Act, however, the FERC is extremely limited in its discretionary ability to change its procedures.* Thus, in its proposed rule changes to institute a "short form" for license applications by small hydro developers, the definition of "small" uses the lower limits of the applicability of these statutes. For the FERC short form, small hydro is defined as:

- 1) Having a dam or diversion structure less than 25 feet in height above the stream bed (because, according to the National Dam Inspection Act, such dams would be in a low hazard category);
- 2) Impounding a reservoir with a surface area of less than 10 acres (because formal consultation with Federal and

*For an explanation of FERC licensing procedures, see pages V-2 to V-9.

state fish and wildlife agencies is not required when the maximum surface area of the impoundment is less than 10 acres);

- 3) Having a power production capacity less than 2,000 horsepower, that is, 1,500 KW (because current FERC regulations require less detail in applications for projects of 2,000 horsepower or less).

These criteria are considerably below those of DOE. Thus, many of those developers granted DOE funding for demonstration projects will have to submit the regular forms for license applications rather than the short form.

The U.S. Army Corps of Engineers, in its 1977 90-day study of hydroelectric power potential at existing dams (See page 1-5), defined small dams as those:

- 1) structures less than 100 feet in height;
- 2) with less than 10,000 acre - feet of reservoir storage capacity;
- 3) with a potential capacity less than 5,000 KW.

In contrast, for the Army Corps of Engineers' inventory of all dams in the United States under the National Program of Inspection of Dams in 1975, dams which did not meet the following minimum criteria were excluded from the survey:

- 1) At least 6 feet in height;
- 2) From 6 to 25 feet in height if the reservoir was greater than 50 acre-feet;
- 3) Height of 25 feet if the reservoir was greater than 15 acre-feet.

Since the Corps was not interested in obtaining information specifically about small hydro, no upper limit was set. It is quite possible, however, that some dams with potential for power production were excluded from the inventory.

These semantic differences may be translated into conflicts at the policy level in terms of information on power potential resulting from funding available for specific sites, and regulatory exemptions. Before explaining these problems, Table 11-1 presents a comparison of the criteria used by DOE, FERC and the Corps' 90-day inventory of small hydro potential.

TABLE 11-1

Federal Criteria for Small Hydro

Criteria Agency	Height - (Feet)		Capacity - KW	Reservoir Storage Area
	Of Head	Of Dam		
DOE	< 66		50 - 15,000	
FERC ("Short Form")		< 25	0 - 1,500	< 10 acres
Corps of Engineers (90-day study)		< 100	0 - 5,000	<10,000 acre-feet

The first problem is the confusion between "height" and "head." The gross head is the amount of fall, in feet, of the water from the top of the dam to the generating equipment. It is quite possible that the height of the head may be much greater than the height of the dam structure -- either because the dam was built above the stream bed or because the penstock (see Appendix A for definitions) was extended to increase the production capacity of the hydro site. Thus a dam structure may have a height of 60 feet with a head of 70 feet, putting it outside DOE's criteria but inside the Corps' definition. This semantic confusion is epitomized by the use of the term "low head hydro" by DOE, reflecting their definition, and "small hydro" by other Federal agencies.

In terms of information, which criteria are used will determine which dams are included in present and future inventories. In its new inventory of dams (see page 111-14), the U.S. Army Corps of Engineers recognizes this fact and thus is defining small hydro sites "flexibly." Because of the nature of the Corps' data computer system, they will have the ability to extract information on dams given any set of parameters. Generally, small hydro is defined as having a capacity of less than 15 MW.

The Corps, in a recent study on small hydro for DOE (see page 111-16) found that "height" has little relevance. Therefore, the Corps has recommended that DOE reconsider its criteria in order to evaluate sites within their specific physical and technical context.

The Bureau of Reclamation concurs in the necessity for a more flexible definition. Although the Bureau's new inventory of Western states (see

page III-11) will not get underway until October 1, 1978 (if it is authorized), the criteria for small hydro will consider a range of heights, rather than strict limits. The problem of high heads accompanied by small capacities is a particular problem in the West because of the location of potential sites on large irrigation canals with drops of more than 66 feet. Despite the name of the inventory ("Low Head Hydro Evaluation and Inventory") the Bureau, like the Corps, will emphasize "small" rather than "low-head."

These distinctions become very important in reference to funding. Many worthwhile projects may be excluded from DOE's program because of the head specifications. Furthermore, FERC's very limited criteria based on environmental considerations will exclude many developers from filing the shortened application form for FERC licenses.

In contemplating new programs or participating in ongoing programs, it is important to consider the implications of these distinctions.

Official Inventory Lists

The number of official inventories of dams in the United States can be quite startling. In addition to the various agencies of the Federal government, every state maintains its own list. To further complicate this cluttered field, a number of special commissions have been formed whose jurisdictions go beyond individual state boundaries and concentrate on particular river basins or drainage systems. All of these inventories are issued from time to time.

The major agencies who prepare inventories are:

- 1) Army Corps of Engineers - the Corps' inventory is primarily concerned with flood control and river regulation. The Corps has the mandate to regulate and inspect dams that affect navigable rivers. Their list will not include dams under 6 feet in height, rivers that do not cross state lines, or are non-navigable.
- 2) Federal Energy Regulatory Commission - this agency is responsible for the licensing of all power producing dams. Sites that went into operation before licensing was necessary or sites that simply never bothered to apply for licenses do not appear on the list. FERC also publishes a list of sites by state that were licensed and are now retired.
- 3) Bureau of Reclamation - this agency operates primarily west of the Mississippi and keeps inventories of dams it has constructed.

- 4) Individual States - each state is responsible for keeping an inventory of sites within its borders. The ability of a state to keep an up-to-date record varies considerably. Some states have few sites and thus this represents no problem. New York State has on record over 6300 dams and therefore its records are frequently out of date, missing or simply wrong. On the other hand, Pennsylvania seems to have the situation well in hand.
- 5) Special Commissions - the New England River Basin Commission, the Delaware Basin Commission, and the Ohio River Basin Commission are specialized organizations that periodically publish inventories of their specific areas of interest.

Now that small scale hydropower has become fashionable, a number of new inventories are being produced (see below, Section III). One of the most advanced (a preliminary inventory has already been published) is being conducted for New York State. By cross-checking all available existing lists, New York was able to publish a list of prime sites this inventory contains 1500 sites, over 400 of those dams did not appear on any list. These sites were located by word of mouth. It is now clear that to be entirely accurate, all sites must be checked by visual inspection.

Using New York State's effort as an example, we can generalize about the size and quality of potential small hydro sites. New York has computerized its inventory so as to make sorting by different category very efficient; i.e. by river basin, dam height, county, etc. The computer selected 75 sites at random and found the average size to be 3 megawatts. (An averagesized, new nuclear or fossil fuel power plant is 800 - 1000 megawatts). While the sites are small in comparison to centralized power plants, the power produced is dedicated to a single or to a restricted number of customers. Since such power potential can only be estimated, a site-by-site physical inspection is necessary to yield an accurate appraisal of potential. Inventories are useful as starting points but unless fully researched and checked, they have serious limitations.

Small Hydro Potential for Low-Income Communities

Ideally, it would be extremely useful to locate, on a map, all low-income communities in proximity to small dams with hydroelectric potential. This was not possible for this report for several reasons, including the data problems of inventories noted above. Existing data for both location of dams and location of specific communities at the level of detail required for a complete listing was not readily accessible in the short time available for this study.

While lists of dams are available from such sources as the U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission, they are neither complete nor entirely accurate. The 90-day Corps' study of hydropower potential in 1977 computed the power potential by using a statistical approach, basin-by-basin, to compute potential rather than a site-by-site analysis. The Corps is presently conducting a site-specific inventory to recompute the power potential of each dam in order to screen out those that are not worth redeveloping. When this data is available (early fall, 1978) it will be possible to get a breakdown of potential by state, river basin, county, town or dam using the Corps' computer data system. Even though this data was not available for this report, it is important to note that it will soon exist.

Some gross generalizations on location can be made, however. Figure 11-1 is taken from the Corps of Engineers estimates noted above. Since physical factors which create regional hydropower potential vary widely across the country, so does the hydropower potential at existing dams in various river basin drainage areas. The Pacific Northwest has the largest hydropower potential as well as the largest installed capacity of any area in the country. For the rest of the United States, generally speaking, physical hydropower potential is roughly proportional to the size of the region except in the arid Southwest. Tables 11-2 and 11-3 show potential capacity and yield at existing dams.

These figures are misleading, however, because they do not take into account economic and institutional factors which may encourage or constrain small hydro development. In terms of cost of electricity from existing dams, producing power from small hydroelectric plants may be more economically feasible in the Northeastern part of the United States. Table 11-4 shows the average price per unit of electricity for household use in the United States in 1975.

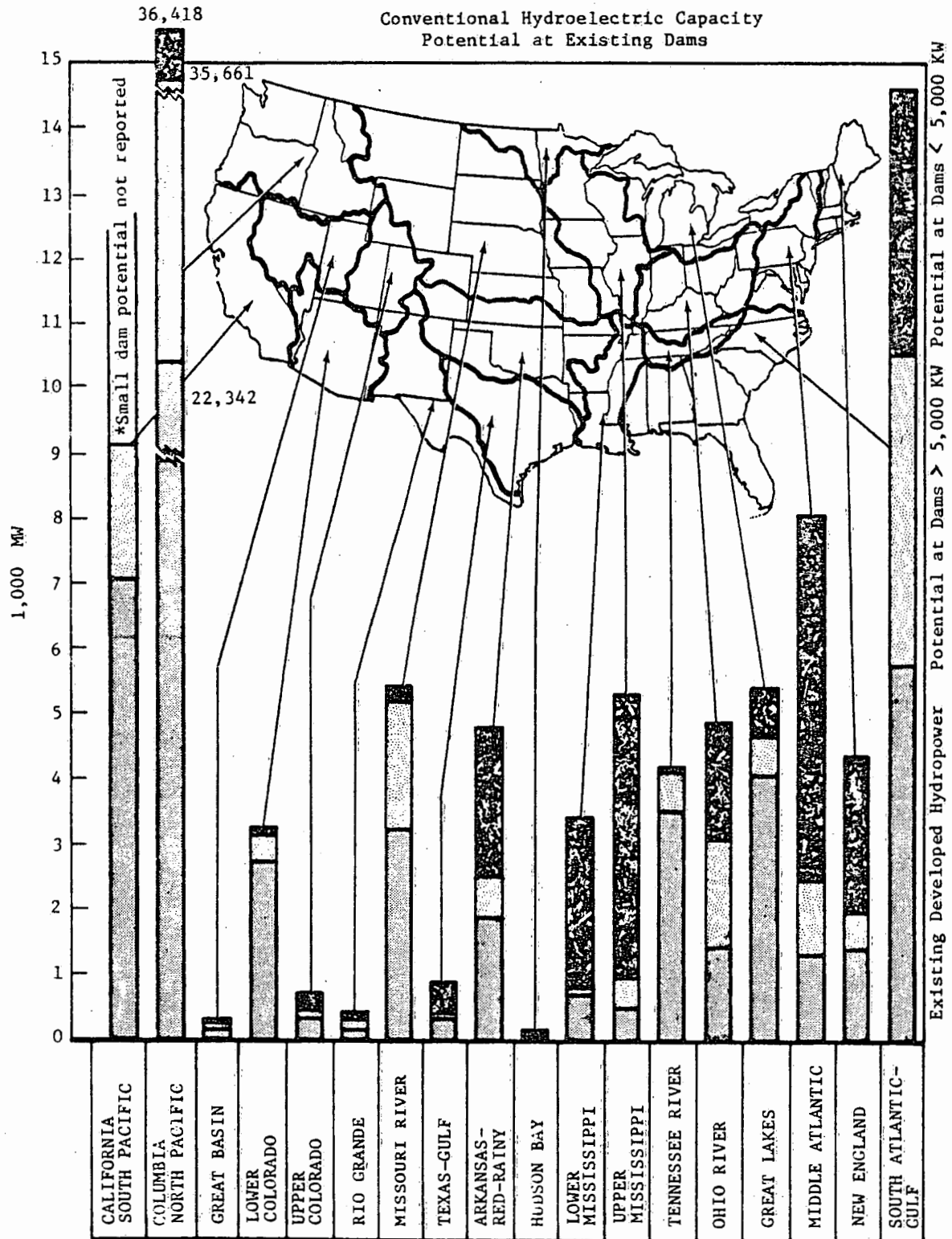
TABLE 11 - 4

Average Price Per Unit of Electricity in Different Regions
of the United States

	Price per Million BTUs of Electricity
Northeast	\$4.21
North Central	3.13
South Atlantic	3.01
South Central	2.22
West	2.29

Source: Washington Center for Metropolitan Studies.
National Survey of Household Energy Use, 1975.

Figure II-1



Source: U.S. Army Corps of Engineers, Institute for Water Resources, Estimate of National Hydroelectric Power Potential at Existing Dams (July 1977), p. 7.

Table II-2

Conventional Hydroelectric Capacity Potential at Existing Dams

	Existing Capacity (MW)	Rehabilitation Potential (MW) (9%)	Hydro Expansion Potential (MW)	Hydro Installation Potential (MW)	Small Dam Potential (MW)	Total Regional Potential (MW)
New England	1,427	127	188	223	2,432	2,970
Mid-Atlantic	1,290	116	565	521	5,580	6,782
South Atlantic-Gulf	5,753	518	3,342	874	4,244	8,978
Great Lakes	4,008	360	253	143	644	1,400
Ohio River	1,465	132	19	1,414	1,873	3,438
Tennessee River	3,658	329	30	0	75	434
Upper Mississippi River	581	52	80	199	4,378	4,709
Lower Mississippi River	724	18	88	25	2,582	2,713
Hudson Bay	13	1	0	0	51	52
Arkansas-White-Red River	1,839	165	236	245	2,318	2,964
Texas-Gulf	393	35	11	43	460	549
Missouri River	3,370	303	1,037	486	250	2,076
Rio Grande River	65	6	20	130	184	340
Upper Colorado River	359	32	15	24	465	536
Lower Colorado River	2,847	256	0	59	87	402
Great Basin	530	48	1	0	85	134
Columbia-North Pacific	22,342	2,010	10,681	628	757	14,076
California-South Pacific	7,050	634	970	514	*	2,118
Alaska	123	11	36	46	25	118
Hawaii	18	2	1	0	30	33
Puerto Rico	0	0	0	0	10	10
Virgin Islands	0	0	0	0	0	0
TOTALS	57,855	5,155	17,573	5,574	26,530	54,832

* No estimate was available for the California-South Pacific Region

Source: U.S. Army Corps of Engineers, Institute for Water Resources, Estimate of National Hydroelectric Power Potential at Existing Dams (July 1977), p. 8.

Table II-3

Conventional Hydroelectric Energy Yield Potential at Existing Dams

	Existing Energy Yield (10 ⁶ KWH)	Rehabilitation Potential (9%)	Hydro Expansion Potential	Hydro Installation Potential	Small Dam Potential	Total Regional Potential (10 ⁶ KWH)
New England	5,719	515	502	517	11,685	13,219
Mid-Atlantic	5,201	477	1,945	792	15,279	18,493
South Atlantic-Gulf	14,521	1,307	9,228	1,255	21,846	33,636
Great Lakes	24,754	2,228	578	580	2,423	5,809
Ohio River	5,505	495	100	4,680	2,849	8,124
Tennessee River	16,112	1,450	139	0	371	1,960
Upper Mississippi River	3,006	270	260	1,077	8,991	10,598
Lower Mississippi River	424	38	136	104	8,110	8,388
Hudson Bay	68	6	0	0	72	78
Arkansas-White-Red River	5,019	452	269	322	6,525	7,568
Texas-Gulf	1,074	97	6	61	1,095	1,259
Missouri River	15,294	1,376	4,632	1,106	580	7,694
Rio Grande	234	21	49	311	788	1,169
Upper Colorado River	1,634	147	80	49	593	869
Lower Colorado River	10,541	579	0	289	526	1,394
Great Basin	1,976	178	1	0	179	358
Columbia-North Pacific	127,182	11,446	14,865	2,949	2,495	31,755
California-South Pacific	33,400	3,006	3,264	2,304	*	8,574
Alaska	493	44	141	239	112	536
Hawaii	104	9	8	0	40	57
Puerto Rico	0	0	0	0	129	129
Virgin Islands	0	0	0	0	0	0
TOTALS	272,261	24,141	36,203	16,635	84,688	161,667

* No estimate was available for the California-South Pacific Region

Source: U.S. Army Corps of Engineers, Institute for Water Resources, Estimate of National Hydroelectric Power Potential at Existing Dams (July 1977), p. 9.

Table 11 - 5 presents a more detailed view of hydropower potential in nine Northeastern states.

More detailed information on low-income communities could also be found, given time and resources. Appendix C lists those data sources available for the Community Services Administration's Community Profile -- a socioeconomic report on more than 3100 U.S. counties.

Focusing only on lists of dams correlated with low-income communities then, could yield an inaccurate picture of actual potential. Given the fact that the potential does exist, despite these data problems, coupled with the short time duration of this study, it was decided to illustrate potential using specific examples. Telegrams were sent to the Governors of all fifty states plus Puerto Rico and the Virgin Islands requesting information on existing small dams with hydro potential located near low-income communities. Of the thirty replies recieved, five were chosen to serve as examples for this study. Even though relying on this data presents only a partial picture, this method does have advantages. First, the dam sites represent an assessment of possible sites at the state level -- often resulting from a preliminary screening prior to application to DOE for Federal grants. Secondly, the responses received indicate an interest on the part of state Governors in the potential development of small hydro sites from Hawaii to Maine and from Alaska to Puerto Rico. Governors' replies from Georgia, Missouri, Wyoming, Washington State, California, and Alaska are reproduced in Appendix D.

The following five tables illustrate State Governors' assessments of hydropower potential for low-income communities for California, Washington, Wyoming, Maine and Missouri. The amount of information received was not always equivalent but some basic data appears in all of the tables. The number and percent poor per county where the dams are located was obtained from poverty statistics from the April 1970 census of 1969 incomes. Since the average percent poor across the United States in 1970 was 13.70 percent, counties with over 13.70 percent of inhabitants listed below the poverty line were included. For the 1970 data, "poor" was defined as families with 1969 cash incomes below the following incomes:

<u>Size of Family</u>	<u>Non-Farm</u>	<u>Farm</u>
1 person	1840	1569
2 persons	2383	2012
3 persons	2924	2480
4 persons	3743	3195
5 persons	4415	3769
6 persons	4958	4244
7 or more (8 average)	6101	5182

Table II-5

Potential Hydro-Power Development
Existing Low-Head Dams in Northeast

INVENTORY OF EXISTING DAMS

<u>State</u>	<u>Total No. of Dams Listed by State</u>	<u>No. of Abandoned Power Sites Identified</u>	<u>No. with Useful Informa- tion Reviewed</u>	<u>No. Suit- able for Power Develop- ment</u>	<u>No. Selected for Further Study</u>
Pennsylvania	2,324	N.A.	2,324	95	5
New Jersey	1,129	16	632	28	4
New York	6,352	200	108	200	2
Connecticut	3,522	N.A.	367	59	2
Rhode Island	521	82	83	50	3
Massachusetts	2,704	222	270	190	2
Vermont	355	100	314	92	3
New Hampshire	3,000	293	182	97	2
Maine	<u>1,010</u>	<u>N.A.</u>	<u>1,010</u>	<u>800</u>	<u>2</u>
TOTALS	20,917	913+	5,290	1,611	25

*Estimate developed by PINY/TAMS from reliable but incomplete data sources.

Prepared by Polytechnic Institute of New York and
Tippetts-Abbott-McCarthy-Stratton
30 April 1977

The tables also contain information on whether Community Action Agencies (CAAs) exist in the counties and what the target population is. This information could be beneficial if CSA were to institute a program encouraging development of small hydro through CAAs.

The tables are generally self-explanatory, but some remarks can be made about the specific data contained therein.

California (Table 11-6)

The potential for using existing irrigation dams for the benefit of low-income persons is illustrated in the California data. Four of the nine dams listed are owned by irrigation districts.

Washington (Table 11-7)

The data sent by the State of Washington included information about the towns where the dams are located as well as county unemployment figures. Since this data does not appear in the table (in an attempt to maintain comparability) the unemployment figures are listed below:

<u>County</u>	<u>Percent Unemployment</u>
Ferry	9.2
Grays Harbor	6.0
Kittitas	10.1
Kittitas	10.1
Okanogan	11.6

Governor Dixy Lee Ray also noted that, if required, "a more comprehensive and detailed assessment of these and other such potential opportunities in Washington State could be provided."

Wyoming (Table 11-8)

The Wyoming Water Planning Program sent detailed information on dam sites nominated by the State of Wyoming for the Corps of Engineers' Special Small Dam Hydropower Study for DOE (see page 111-16). The information sent included data on type, condition, and structure of dams, possible customers for the power produced, stream flow, and ownership. One dam, Keyhole Dam and Reservoir in Crook county, was not included in the table because the percent of low-income people in the county was 12.27 -- below the national average of 13.70 percent. The letter from Wyoming, however, notes that two towns near the dam, Sundance and Hulett, "are two lower income towns in Wyoming." This fact points out the danger of relying on county-level data in determining sites near low-income communities.

TABLE II-6

CALIFORNIA

County*	% Poor**	No. Poor**	CAA ⁺	Target Population ⁺	No. of Dams*	Names*	Capacity* -mw	Owner
Yuba	18.28	1,693	No		1	Virginia Ranch Dam	0.5	Browns Valley I.D.
San Luis Obispo	16.04	2,631	Yes	14,872	1	Nacimiento Dam	4	Monterey Co. F. C. & W.C.D.
Butte	15.76	4,975	Yes	17,020	2	Concow Dam Sly Creek Dam	Insufficient Data 10	Thermalito I.D. Oroville-Wyandotte I.D.
San Joaquin	13.98	6,581	Yes	40,576	1	Camanche Dam	6	East Bay M.U.D.
Plumas	13.96	1,092	No		4	Antelope Dam Frenchman Dam Grizzly Valley Dam Little Grass Valley Dam	1 2 2 14	Cal. Dept. of Water Resources " " Oroville-Wyandotte I.D.

Legend: Co. F.C. & W.C.D. - County Flood Control & Water Conservation District
 I.D. - Irrigation District
 M.U.D. - Municipal Utility District

Sources:

- * - Energy Division, Dept. of Water Resources, State of Calif. (7/10/78)
- ** - Poverty Statistics from April 1970 Census of 1969 Incomes (CSA)
- + - Directory, Community Action Agencies and State Economic Opportunity Office, Information Support Branch, Community Services Administration (Nov. 1977)

TABLE II-7

WASHINGTON

County*	% Poor**	No. of Poor*	CAA ⁺	Target Population ⁺	No. of Dams*	Name*	Head*	Ave. Flow (cfs)*
Ferry	18.71	594	Yes	5,453 (for Ferry Pend Oreille & Stevens Counties)	1	Granite Creek	30	20
Kittitas	15.63	1,360	Yes	3,701	2	Lake CleElum Eastern Diversion Dam	124 56	934 1,066
Okanogan	14.59	2,475	Yes	4,068	1	Enloe Dam	60	2,300
Grays Harbor	13.81	3,094	Yes	7,396	1	Wynoochee Dam	162	1,260

Sources:

*Private communication from The Honorable Dixy Lee Ray, Governor, State of Washington

**Poverty Statistics from April 1970 Census of 1969 Incomes, Community Services Administration

⁺Directory, Community Action Agencies and State Economic Opportunity Office Information Support Branch, Community Services Administration (Nov. 1977)

TABLE II-8

WYOMING

County*	% Poor**	No. Poor**	CAA ⁺	Target Population ⁺	Number of Dams*	Name*	Owner*	Height* (Structural)
Fremont	18.33	1,814	Yes	8,795 (includes 4 other counties)	3	Pilot Butte Power Plant (retired)	USBR	
						Bull Lake Dam	USBR	81
						Wind River Diversion Dam	No info	37

Legend: USBR - U.S. Bureau of Reclamation

Sources:

*State Engineer's Office, Wyoming Water Planning Program, State of Wyoming

**Poverty Statistics from April 1970 Census of 1969 Incomes, Community Services Administration

⁺Directory, Community Action Agencies and State Economic Opportunity Offices, Information Support Branch,
Community Services Administration (Nov. 1977)

Wyoming has other potential small hydro sites, many associated with large irrigation districts but as yet no in-depth analysis has been done.

Maine (Table 11-9)

The State of Maine is currently reviewing the hydroelectric potential of small dams in the State. The numbers included here are taken from Corps of Engineers' lists and are, therefore, subject to the pitfalls previously noted. One interesting example is available, however. Recently, an article appeared in Time Magazine (July 17, 1978, page 5) on the rebuilding of the Brown's Mill dam in Dover-Foxcroft, Maine. Dover-Foxcroft, with a population of 4,000, is located in Piscataquis county and 14.92 percent of the residents make incomes considered below the poverty line. The new dam will provide power for adjacent buildings owned by Charles MacArthur. MacArthur plans to rent out heated, lighted space to perhaps 60 different cottage industries for \$1.00 a day.

Missouri (Table 11-10)

There are over 3,000 dams in Missouri -- a fact which precluded detailed analysis in response to this study's request. The Missouri Department of Natural Resources, however, included information on several mills which might feasibly be altered for hydropower generation. All of the dams in Missouri's list are located within the criteria for low-income counties adopted here.

As noted above, the information from these tables can only serve as illustrations of possible potential. The purpose for including them here is twofold. First, it can be seen that the potential capacity as well as the required interest at the State level does exist. Second, there is a definite need for more information and detailed analysis on a site-by-site basis in order to accurately assess whether or not redeveloping a specific dam will benefit any specific community.

As one example, there is an existing dam which once produced power at Juliette, Georgia on the Ocmulgee River, formerly owned by the Juliette Milling Company. The dam at one time had an installed capacity of 1,022 KW and an average annual generation of 2,000 KWh. Juliette is located in Monroe County, in which 22.09 percent of the residents had 1969 cash incomes below the poverty line. This data, to be useful, would have to be supplemented with detailed information on the dam, water flow, community, local industry and relevant institutional problems.

TABLE II-9

MAINE

County*	% Poor**	No. Poor**	CAA ⁺	Target Population ⁺	Number of Dams* (not developed for power)
Washington	23.18	6,758	Yes	12,483 (includes Hancock)	22
Aroostook	19.09	17,742	Yes	17,742	16
Waldo	17.01	3,913	Yes	3,913	19
Hancock	16.85	5,725	Yes	12,483 (includes Washington)	16
Somerset	15.85	6,364	Yes	10,253 (includes part of Kennebec county)	26
Knox	15.71	4,450	Yes	4,450	9
Lincoln	15.27	3,103	Yes	8,857 (includes part of Cumberland, all Sagadahoc counties)	9
Piscataquis	14.92	2,418	Yes	18,080 (includes Penobscot county)	31

Sources:

*Inventory of Dams in the United States, U.S. Army Corps of Engineers, May, 1975

**Poverty Statistics from April 1970 Census of 1969 Incomes, Community Services Administration

†Directory, Community Action Agencies and State Economic Opportunity Offices, Information Support Branch, Community Services Administration (Nov. 1977)

TABLE II-10

MISSOURI

County*	% Poor**	No. of Poor**	CAA ⁺	Target Population ⁺	Number of Dams* Listed	Name*
Oregon	39.84	3,613	Yes	(No numbers for individual counties)	1	Falling Spring
Shannon	37.05	2,660	Yes		1	Alley Spring
Douglas	36.36	3,328	Yes		1	Topaz Mill
Ozark	34.49	2,143	Yes		3	Aid-Hodgson Dawt Mill Rockbridge Mill
Bollinger	31.97	2,800	Yes		1	Dolle Mill
Carter	27.44	1,060	Yes		1	Mill Spring
Iron	27.32	2,522	Yes		1	Robinson Mill
Dent	24.74	2,831	Yes		1	Montauk Mill
Laclede	22.90	4,527	Yes		2	Dry Knob Mill Orla Mill
Crawford	20.90	3,076	Yes		1	Dillard Mill
Cape Girardeau	14.51	6,736	Yes		2	Appleton Mill Bollinger Mill

Sources:

*Private Communication from Robert S. Townsend, Acting Director, Division of Policy Development, Missouri Department of Natural Resources, State of Missouri (6/28/78)

**Poverty Statistics from April 1970 Census of 1969 Incomes, Community Services Administration

⁺Directory, Community Action Agencies and State Economic Opportunity Offices, Information Support Branch, Community Services Administration (Nov. 1977)

III. CURRENT GOVERNMENTAL PROGRAMS

As noted in the Introduction, interest in the development of small hydro-electric sites has grown within the Federal government. In the face of high fossil fuel costs and concern about environmental and safety hazards of nuclear power plants, the search for alternatives has been broadened to include such possible energy producers as the sun, the wind and water.

This section focuses on current programs (with reference to relevant past activities) of the major agencies involved in the development of small hydro sites: the Department of Energy (DOE), the Federal Energy Regulatory Commission (FERC), the Bureau of Reclamation, and the U.S. Army Corps of Engineers. Its purpose is to pinpoint the activities of these agencies as well as the level of their support for these efforts. Brief reviews are also given of state and regional activities in New York, New Hampshire and the Northeast region of the United States.

Before examining specific agency activities, however, Congressional attitudes and initiatives must be addressed. Congressional support, of course, is essential for a viable federal program.

CONGRESSIONAL INITIATIVES

In a recent article on Congressional and Administration interest in hydropower development,¹ it was noted that "the President has managed to lose the initiative on this issue... Congress has taken the lead." It was President Carter, in his national energy plan of April 1977, who first ordered a study of the "potential for additional hydropower installations at existing dam sites throughout the country." Since then, however, Congress has taken over the Administration in "authorizing funds and mandating actions not requested -- and, in some cases, resisted -- by the Administration."²

This situation has produced complaints from key Congressional supporters of hydropower development. Senator John A. Durkin (D - New Hampshire) is the prime supporter on the Senate side and has accused Energy Secretary Schlesinger of hindering renewable energy options, such as small hydro and solar. Durkin charged that "Schlesinger wants to make it impossible to go any route other than nuclear."³

Congressional initiatives basically fall into three categories: authorizations for the Department of Energy; provisions for loans to promote small hydro in the national energy package; and regulatory provisions, also in the national energy bill.

DOE Authorization Bills

Both the Senate and the House are agreed on the necessity for a small hydroelectric research, development and demonstration program. Without waiting for an Administration request, Congress authorized \$15 million (of which \$10 million was eventually appropriated for fiscal 1978) to demonstrate the feasibility of small hydro projects and perform the necessary back-up studies. In addition to these funds, \$1.6 million in 1977 funds had been reprogrammed late in the fiscal year, in response to pressure from Senator Frank Church of Idaho, to begin a small hydro demonstration at three dams at Idaho Falls which had been damaged by the collapse of the Teton Dam.

The Administration's 1979 budget request for DOE's new Hydroelectric Resources Development Division was \$28 million.

Loan Program

In May 1977, Rep. Richard L. Ottinger (D - New York) introduced legislation to provide \$100 million a year in grants and loans to stimulate development of hydro installations of less than 15 megawatt capacities. Senator Durkin introduced a similar bill in the Senate a month later. Both measures eventually became amendments to the Public Utilities Regulatory Policy Act of 1977 (H.R. 4018) -- the public utilities reform segment of the Carter energy package.

While the energy package as a whole has not yet been passed, the House and Senate Conferees completed action on December 1, 1977, on the section dealing with Public Utility Regulatory Policies. The summary of the conference agreement (which is not an official document) provides for two loan programs; one for feasibility studies (\$10 million per year for 3 years) and the other for project costs (\$100 million per year for 3 years). Specifically, the summary states that:

The conferees authorized a Department of Energy loan program to encourage the development of small hydroelectric facilities in existing dams.

Loans of up to 90% of the cost of feasibility studies for hydroprojects may be made to the owner of a dam. The balance of any loan shall be forgiven if the Secretary determines that the project is not technically or economically feasible.

Loans for up to 75% of the cost of a project may be made with the following restrictions:

- (1) preference shall be given to applicants who do not have access to alternative financing.
- (2) the maximum term of a loan shall be 30 years.
- (3) the proper licenses must have been approved.⁴

Project cost loans would cover architectural, engineering, and construction costs and would be limited to those projects which have no significant adverse environmental impacts.

Regulatory Reform

The Public Utility Energy Policies Act of 1977 also contains provisions on regulatory reform, to "cut through the unnecessary red tape and accelerate utilization of this energy source."⁵ These provisions deal with 1) licensing procedures, 2) cogeneration, 3) rate structures and 4) exemption from Federal and State regulations.

- (1) The Conference agreement directs the Federal Energy Regulatory Commission to simplify and expedite licensing procedures for low-head hydroelectric projects at existing dams.⁶
- (2) The Conference agreement provides that the Federal Energy Regulatory Commission (FERC) shall prescribe rules requiring electric utilities to offer to sell power to or buy power from qualifying cogenerators or small power producers. A small power producer is someone not primarily engaged in generating or selling electric power (and) who produces less than 80 megawatts of electricity from solid waste or renewable resources. A qualifying cogenerator is the owner of a cogenerating facility that meets certain minimum size, fuel use and fuel efficiency requirements prescribed, by rule, by FERC.
- (3) FERC will prescribe by rule procedures to ensure that the rates set by State regulatory commissions for such sales will be subject to specified limits and will not discriminate against the cogenerators, small power producers or customers of the utility.
- (4) FERC shall prescribe rules exempting qualifying cogenerators and small power producers of up to 30 megawatts from State utility regulations, the Federal Power Act, and/or the Public

Utility Holding Company Act, if the Secretary of Energy determines such exemption is necessary to carry out the purposes of the Act.

In addition, the Federal Energy Regulatory Commission shall have discretionary authority to grant an exemption to Part I of the Federal Power Act to any facility of less than 15 megawatts which is located on non-federal lands and uses the hydroelectric potential of manmade conduits not built primarily for the generation of electricity.⁷

DEPARTMENT OF ENERGY

In introducing his national energy plan in April 1977, President Carter made reference to the potential of small hydroelectric facilities as one economic, alternative energy source. Carter noted that hydroelectric capacity at existing dams "could be installed at less than the cost of equivalent new coal or nuclear capacity."⁸

After what Congress considered foot-dragging on the part of the Administration, as noted above, \$10 million was appropriated for a small hydro program in the Department of Energy (See page III-1 for Congressional actions). Secretary of Energy James Schlesinger stated during Senate hearings on March 1, 1978, that: "when we identify the sites, there will be a major emphasis on lowhead hydro. It is not -- any more than anything else -- a cure-all, but it will be a substantial alternative, particularly attractive in New England."⁹

DOE's program to stimulate the utilization of low-head hydroelectric power is located in the Hydroelectric Resources Development Division,* of the Office of Emerging Energy Resources under the Assistant Secretary for Resource Applications. DOE's program, however, is decentralized since the Idaho National Engineering Laboratory does most of the contracting for studies.

To meet the objective of stimulating small hydro development, DOE's program strategy is to: (1) provide financial assistance for making assessments of existing dams and, subsequently for new dams, for use by public and private organizations in decisions affecting commercialization activities; (2) improve assessment technology to aid the private sector in evaluating lowhead hydroelectric production at existing dam sites and new sites; (3) stimulate the use of low-head hydroelectric energy by the reduction of construction and equipment costs through an engineering development program; (4) provide the private sector with environmental assessments and improved environmental assessment; and (5) provide the private sector with engineering and economic information based on the results of specific feasibility assessments (including conceptual designs) and the construction and

*The present director of this Division is Richard McDonald, the author of the Corps of Engineers' 90-day study.

operation of jointly funded demonstration plants.¹⁰

The long-term objectives and goals of the DOE low-head hydropower program are to:

1. Assist and encourage the private and non-Federal public sectors to accelerate the development of low-head hydroelectric resources at suitable existing dam sites, with emphasis on those sites with a rated capacity between 50 KW and 15 MW.
2. Encourage utilities over the long term to install hydroelectric generating plants at new dam sites suitable for low-head hydroelectric power production.

For Fiscal Year 1978 DOE's program consists of six areas:

- Resource Assessment
- Engineering Development
- Environment and Safety
- Institutional/Legal/Economic Analyses
- Information Dissemination and Data Collection
- Feasibility Studies and Demonstration Projects

In budgetary terms, \$3.6 million of the \$10 million appropriated in FY 1978 for small hydro is allocated to the first five program areas. The remainder, \$6.4 million, is being used for feasibility studies and demonstration projects. A brief review of the six areas follows.

Resource Assessment

One of the priorities of the program is to refine and expand the past inventories of existing hydro potential to obtain a more accurate resource assessment. To this end, ongoing inventories of the U.S. Army Corps of Engineers and the Bureau of Reclamation (in FY 1979) will be utilized. In addition, the River Basin Commissions, under the Water Resources Council (particularly the New England River Basin Commission) will contribute information. Also of interest, the University of Idaho is developing a methodology to assist future inventories in collecting accurate, up-to-date information.

Engineering Development

The objective of the program on engineering development is to reduce the costs of redeveloping dam sites. Specific technical problems to be dealt

with include the physical limits of head size and turbine design. Of particular interest are methods for storing energy downstream since the small hydroelectric producer often cannot meet the demand of consumers during peak periods when storage capacity to match the demand curve is not practical for physical or environmental reasons or when run-of-the-river water must be utilized. To be able to increase economic value by retiming production of capacity and energy, solutions to the storage problem are being investigated. Both the Bureau of Reclamation and the University of Idaho are addressing these issues.

Environment and Safety

Environmental concerns seem to be minimal with regard to sites where dams already exist (See page IV-1). However, the Department of Energy is looking at this area because potential impacts increase as the possibility of added storage capacity becomes an attractive option. Specific problems include the impact on fish life and the possibility of constructing fish passage facilities. DOE is also interested in smoothing out the environmental impact statement process for small hydro developers.

This is a relatively low-level area in DOE's program but necessary in order to anticipate possible future problems if the wholesale development of small hydro facilities becomes more attractive to utility companies and other private developers.

Institutional/Legal/Economic Analyses

Many observers, especially industry, view the removal of institutional barriers as the critical factor in the development of small hydroelectric facilities. This relates to the fact that the majority of small dams are privately owned and these owners do not have the technical expertise nor the capital to redevelop potential hydro sites. In line with DOE's objectives to facilitate the commercialization of small hydro development, activities in this area focus on identification of barriers and mobilization of forces at the local level to demand the institutional changes necessary to encourage rather than frustrate such development.

DOE contracted with the Applied Physics Laboratory of Johns Hopkins University to evaluate the institutional, environmental, and ecological factors in the development of low-head hydroelectric power at existing dams in New England. An interim report was issued in November 1977 with a second report issued in February 1978. To go beyond the Johns Hopkins report by concentrating on actual situations of redevelopment, DOE contracted for a study by the Franklin Pierce Law Center of the University of New Hampshire working with state energy offices nation-wide. Issues which appear to be critical include water rights and water law, insurance, and the entire regulatory system -- state, local and Federal.

In addition to identifying institutional barriers, DOE's program is also designed to identify and encourage legislative changes to make small hydro development more practical and economical. To this end, a research group of the National Conference of State Legislatures is studying possible state initiatives.

Data Collection and Information Dissemination

Because of the massive amount of data needed to assess and evaluate the small hydro potential of the United States and the increasing number of projects and programs in this area, a comprehensive system of data collection and information dissemination is necessary. The Idaho National Engineering Laboratory is developing a computer collection and sort capability to meet this need.

Feasibility Studies and Demonstration Projects

Finally, the greatest emphasis, in terms of both funding and effort, is on the feasibility studies and demonstration projects. The Department of Energy solicited proposals in response to a Program Research and Development Announcement (PRDA) for determining feasibility of potential low-head hydroelectric power development projects at a variety of existing dam sites. Proposals were considered for financial support to evaluate the economic, engineering, and environmental feasibility and to develop conceptual design for these dam sites. In April, 1978, DOE awarded 56 contracts out of the 200 applications received as a result of this PRDA, with a total funding of about \$2.5 million and with a maximum award of \$100,000 to individual projects (See Appendix E for list of projects awarded). The feasibility assessment should take no more than six months.

The applications for feasibility projects were ranked on a variety of criteria. DOE was interested primarily in diversity to illustrate the feasibility of a wide range of potential sites and uses. Regional distribution was a factor as well as variety of types of developers (for example, public and private, utility companies and individuals). The resulting feasibility studies will cover different end uses (from power generation to selling to a central grid to local immediate uses such as industry) and a variety of dam sizes (from 12 feet to 65 feet heads, 250 KW, to close to 14,000 KW the cut-off point).

On June 23, 1978, DOE issued a "Program Opportunity Notice" (PON) on "Low-Head Hydroelectric Power Demonstration Projects" (PON ET-78-N-07-1711) with a closing date of September 20, 1978. Proposals are being solicited for the design, construction, and operation of a low-head hydroelectric power demonstration plant at the site of an existing dam where feasibility

assessments have already been completed. The objectives of this demonstration program are to:

- (1) demonstrate that the commercially available technology is economically viable in a commercial-sized plant for low-head hydroelectric power generation;
- (2) obtain realistic cost data from which commercial production costs can be predicted with a high degree of confidence;
- (3) address specific marketing, environmental, legal and institutional concerns and identify opportunities for direct participation of the private and public sectors in development and demonstration of low-head hydroelectric energy;
- (4) demonstrate that low-head hydroelectric resource utilization is compatible with other uses of water;
- (5) provide data on dam safety and structural integrity; and
- (6) disseminate initial economic and financial data regarding the cost of operating and maintaining low-head hydroelectric power facilities.¹²

Cost sharing will be on the following basis:

The proposer must finance 50% or more of the entire demonstration project. If the proposed demonstration project consists of a series of "n" number of co-dependent dams, the maximum cost-sharing that DOE will consider is 50% of 1/n of the total project costs. For each award, DOE's maximum financial participation will be \$5 million.¹³*

Two or three demonstration projects will be awarded under this PON. A second PON for demonstration projects will be issued later to coincide with the completion of the 56 feasibility studies previously awarded by DOE.

In conclusion, DOE's program can be characterized as a "market pull" approach. Rather than forcing small hydro development from the top down, DOE hopes to encourage those at the state and local level to break down barriers to development by DOE's illustration of the economic, social and environmental feasibility of small hydroelectric power generation.

FEDERAL ENERGY REGULATORY COMMISSION

Early in the infancy of water resources development, Congress realized

* Since completion of this study, DOE's share of financing has been reduced.

that it could not continue to authorize each water project through special legislation. Therefore, Congress divided its authority, retaining the direct authority over Federal development and delegating to the Federal Power Commission through the Federal Water Power Act of 1920 the authority to license non-Federal hydroelectric developments. The Act was substantially amended and took on its present form in 1935. The Commission is authorized to license non-Federal developments that (1) occupy in whole, or in part, lands of the United States; (2) are located on navigable waters of the United States; (3) utilize surplus water or water power from a government dam; and (4) affect the interests of interstate commerce. Court interpretations of the Commission's jurisdiction have defined this authority so that it covers virtually all projects.

For any potential developer unsure of the jurisdictional status of a project, there is a relatively simple legal procedure that can be followed to obtain a Commission decision on a particular project. A Declaration of Intention filed pursuant to Part 24 of the Commission's Regulations is a formal request for a jurisdictional finding. The requirements of Part 24 are short and uncomplicated, and can be completed with a minimum of data, much of which is usually available from published sources. A simpler and more direct method is to request an unofficial opinion from the FERC Staff. Usually this will suffice.¹⁴

Federal Power Commission studies with respect to the hydroelectric power resources of the United States are made under the provisions of section 4(a) of the Federal Power Act, which authorized the Commission "To make investigations and to collect and record data concerning the utilization of the water resources of any region to be developed, the water power industry.... and concerning the location, capacity, development costs and relation to markets of power sites ... " Publication of the results of these studies, authorized by section 4(d) of the Federal Power Act, is to facilitate use of the data by various Federal, State, local, and international bodies, and industry concerned with water power resources development.¹⁵

On January 1, 1976 the Federal Power Commission issued the seventh in a series of reports on Hydroelectric Power Resources of the United States: Developed and Undeveloped. The report presents data on the capacity, generation and other characteristics of the developed and undeveloped hydroelectric power resources of the United States. Principal statistics are shown by major drainages and river basins and by geographic divisions and States. Earlier editions were published for the years 1953, 1957, 1960, 1964, 1968 and 1972.¹⁶

The Federal Power Commission's data for developed projects is limited to those with installations of 100 KW or greater and includes all projects for which the Commission had granted, or received an application for, a license. For undeveloped projects, projects with proposed installations of less than 5,000 kilowatts are generally not included in the undeveloped listings unless they have FPC licensing status or are authorized for Federal construction.

The 58-year old FPC has been operating since October 1, 1977 as the Federal Energy Regulatory Commission, or FERC. When President Carter proposed a reshuffling of the energy bureaucracy early in 1977, he suggested that the FPC be made part of the Department of Energy. But Congress, fearful of vesting too much authority over energy pricing in the hands of the executive branch, decided over President Carter's objections to establish an independent commission and to give it even more duties than the FPC had.

When the Energy Department came into existence on October 1 after enactment of the Department of Energy Organization Act (91 Stat 565), the new FERC also was born - and was placed in the unusual position of operating as an independent agency within the realm of the department.¹⁷

One of the major obstacles to increased small hydro development has been the lengthy and, therefore, expensive process in obtaining licenses from the FERC (See page V-2 for explanation of the process). To alleviate this situation, the FERC's Licensed Projects Division* has been working to simplify licensing procedures for small hydro developments.

On April 21, 1978, the FERC issued proposed changes in its rules and regulations to institute a short-form license for small projects (1,500 KW or less). This is the first of a three-phase program to simplify all its regulations. The FERC is now in the process of preparing simplified regulations for projects 15 MW or less located at existing dams or other facilities. The target date for issuance of these regulations is September 1978. FERC would then begin revising regulations for projects of more than 15 MW installed capacity. There is also under consideration proposed revisions for processing Permit applications. The intent is to reduce this to as little as three months. The FERC is also considering other changes such as (1) shorter agency comment periods; (2) earlier start of Staff environmental assessments and other studies; (3) elimination of application processing steps; (4) instituting memoranda of understanding with other Federal agencies; (5) issuance of guidelines to assist applicants; and (6) an increase in FERC Staff.¹⁸

BUREAU OF RECLAMATION

Performing in the 17 Western States area since 1902, the Bureau of Reclamation within the Department of Interior has constructed and currently operates 49 powerplants with a combined capacity of 9,705 megawatts. The Bureau has constructed over 16,000 miles of transmission lines and 295 substations. In addition, Reclamation has under construction five hydroelectric power installations with a total capacity of 3,445 MW.

The 1977 legislation creating the Department of Energy transferred for operation all but 276 miles of transmission lines and approximately one-half of Reclamation's former substation transformer capacity to the DOE's Western Area Power Administration located in Denver. With some simplification, a

*Ron Corso, the Deputy Director of the Licensed Projects Division, has been particularly involved in this endeavor.

general explanation of the transfer is that Reclamation will continue to construct, operate, and maintain transmission and substation facilities that directly supply power to Reclamation operated water supply projects.

In February 1977 the Bureau issued a report on its Western Energy Expansion Study (WEES). The study was conducted in order to pinpoint:

.....opportunities to respond to urgent needs for additional electrical power and energy in the West which can make an effective contribution to conservation of dwindling oil and natural gas resources.¹⁹

This study was not an all-inclusive inventory but an attempt to draw previously formulated ideas "off the shelf" of regional planners. Focus of the study was primarily on development of hydroelectric power, including pumped storage, at both new sites and existing facilities. Few small scale hydro projects were identified, however. Other opportunities relate to development of electrical energy using solar (direct radiation and wind) and geothermal resources. In addition to developmental opportunities, several matters of a policy nature were discussed and evaluated. As a result of the study the report recommended that:

Reclamation initiate an accelerated program for investigation of additional electric power and energy development in the West. In this accelerated program, highest priority should be given to uprating of existing Reclamation powerplants and to expanding power and energy production at existing Reclamation developments. Immediate consideration should be given to appraisal and feasibility studies of large hydroelectric pumped-storage powerplants. Hydroelectric and pumped-storage inventories, studies of a policy nature, and studies of possible integration of solar and geothermal energy into Reclamation power systems should also receive early study.²⁰

Due in part to the timeliness of the WEES, the Bureau received the Carter Administration's support for significant increase in hydroelectric planning activities of its fiscal year 1978 and 1979 General Investigations programs. Included in Reclamation's fiscal year 1979 plan formulation program, and also proposed in the WEES report, is a study entitled Low-Head Hydroelectric Evaluation and Inventory. This is a planned 3-year effort costing \$900,000. The primary objective is to determine the economic and environmental viability of specific small hydropower sites in the Western United States and to provide a full evaluation and estimate of the magnitude of potentials in the area. Emphasis will be placed on small hydro potentials at existing water resources facilities such as dams, canals and waterways. It is anticipated this low-head study will be executed much in the manner of the Western Energy Expansion Study. The Bureau plans to begin to develop study method-

ology and criteria soon so that the inventory effort may begin early in FY 1979. As an initial effort, the Bureau will develop simplified hydrology routines to be used by all regions for a first-cut evaluation of the power potential at any given small hydro site. Close liaison will be maintained with the Corps of Engineers so that the Bureau's study methods and results will be consistent with the efforts under the Corps of Engineers' National Hydropower Study.

In addition to its developmental role, Reclamation has an active research function, which includes energy-related special studies totalling nearly \$5 million in budget over the next four years. Included in these activities are research efforts related to small hydropower technology being undertaken cooperatively with the Department of Energy. Five research studies are presently being initiated under this cooperative agreement. They are:

- (1) A Study of the Lower Limits of Practical Application;
- (2) A Power Marketing Study;
- (3) A Study of Standardized Inlet/Outlet Designs;
- (4) A Study of Standardized Precast Modular Construction;
- (5) A Study of Power Grid Interties.

The Lower Limits of Practical Application study will define the hydraulic head and unit size lower limits for which low-head power generation can be feasible in terms of both technical and economic factors. The study is being limited to practical physical and economic lower limits. Other factors such as environmental, and social impacts will not be evaluated.

The Power Marketing research will identify the major factors involved in power marketing, such as type of power, customers, and systems integration. The objective is to provide insight on the salability of small hydropower and its potential for generating sufficient income to recover costs over a minimum of 50 years or the economic life of the facility.

The first effort of the Standardized Inlet-Outlet Structures Study will include a state-of-the-art review to determine current design practice regarding entrances and diffusers for small head turbines. The ultimate objective of the research will be to prepare a design manual to standardize the design of the flow passages with respect to hydraulic and structural parameters.

The intent of the Precast Modular Construction study is to develop precast concrete modules which can be independently fabricated, transported, and installed to form a solid water barrier. This should have technical and economic advantage in small hydropower facilities development.

The Power Grid Intertie study is important because a large number of small hydropower installations in a given power system may be expected to create system stability problems. In general, use of a significant number of

bulb turbines (for explanation, see Appendix B) could be more sensitive to small variations in power flow with a greater potential to disrupt the system.

Also included in the FY 1979 budget is a request for funding of four small hydro, site-specific appraisal studies at:

- o Yellowtail-after-Bay (Montana);
- o Willwood Dam and Reservoir (Wyoming);
- o Red Bluff Division Dam (California);
- o Boise Diversion Dam (this is one low-head site out of a potential four-unit generating complex in the Boise, Idaho area).

The appraisal studies will be completed in one to two years, after which the Bureau will recommend for or against a feasibility study. The results of feasibility studies will determine whether or not the Bureau seeks construction and authorization funds. Feasibility study and construction authorities must be individually obtained from the Congress (in the House, the Public Works Committee; in the Senate, the Energy and Natural Resources Committee) for each site.

U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers has traditionally been responsible for rivers and harbors as part of the federal government's jurisdiction over navigable water. As time passed the Corps grew more firmly entrenched in its public works role and became increasingly "civilianized." Eventually, it became an autonomous agency with strong ties to the public works committees of the House and Senate. Initially the Corps of Engineers discouraged dam building for hydroelectric power since dams would interfere with navigation. In 1909 however, Congress required the Corps:

...to consider hydroelectrical power in their river studies. In 1925 it more forcefully required the Corps of Engineers to recommend locations that might be developed for hydro-electrical power.²

Presently the Corps has jurisdiction over all dams on federal property and is now in the business of constructing hydroelectric facilities.

Prior to the 90-day study on hydro potential mandated by President Carter, the Corps compiled a comprehensive inventory of dam sites in the United States for the report of the National Program of Inspection of Dams, issued in May 1975. The data in this report shows that there are approximately 49,000 dams in this country of at least 25 feet in height. The information contained in this inventory, however, was incomplete and sometimes inaccurate.

Therefore, the Water Resources Development Act of 1976 (Public Law 94-587, October 22, 1976) authorized the Corps of Engineers to conduct a "National Hydroelectric Power Resources Study" (NHS). Congress appropriated \$7 million for the study which is to be completed within 3 years. In addition to the NHS, \$5 million was appropriated per fiscal year for 1978 and 1979 to undertake feasibility studies of specific hydroelectric power installations on already-authorized federal projects. To achieve the purposes of the study, the Corps established the following objectives:

- (1) to analyze and define the nation's needs for hydroelectric power;
- (2) to assess the potential for increasing hydroelectric power capacity and generation;
- (3) to determine the feasibility of increasing hydroelectric generation capacity by development of new sites, by the addition of generation facilities to existing water resource projects, or by increasing the efficiency and reliability of existing hydropower systems;
- (4) to analyze the current institutional and policy setting for hydroelectric power planning, development, marketing and utilization;
- (5) to assess the general environmental and socio-economic impacts of hydropower development;
- (6) to recommend to Congress a national hydropower development program and a set of institutional and policy modifications which would increase the effectiveness of existing and future hydropower developments.

To meet these objectives there are basically three parts of the study: inventory of hydropower potential; formulation of hydropower plans; and special studies on institutional and structural issues.

One of the primary purposes of the National Hydropower Study is to provide an accurate assessment of the national potential for increasing hydroelectric power capacity and generation. This assessment will not be limited to resources under the jurisdiction of the Secretary of the Army (although later detailed studies will). The assessment will include information from other Federal agencies such as the Bureau of Reclamation and the TVA, will address conventional hydroelectric potential (both high head and low head) and pumped storage, and will attempt to provide an estimate of the potential that could be realized through reallocation of existing reservoir storage, modification of existing project operations, and through uprating existing units or through possible advances in mechanical technology.

The assessment and evaluation of the physical potential for hydropower generation will be a continuous activity over the entire three-year study effort. This part of the overall study can be divided into three major categories: a preliminary inventory; hydropower assessment and evaluation studies; and studies of special topics.

Preliminary Inventory. The preliminary inventory will be initiated and completed during FY 1978. The inventory will proceed in two steps. The initial activity will produce a comprehensive listing of existing projects and undeveloped sites, will require rough screening based on estimated capacity and will require a limited amount of supplemental data to be collected. A data collection form has been developed for Phase I of the preliminary inventory.

The second phase of the preliminary inventory is directed toward estimating the hydropower potential (capacity and average annual generation) of all sites identified in Phase I and the collection of a common set of data for a limited set of the projects or sites. The preliminary inventory will be the major source of information on the national hydroelectric power potential for an interim report which will be prepared by December 1978.

Hydropower Assessment and Evaluation Studies. Because of time and funding limitations, the estimates of capacity and energy included in the preliminary inventory conducted during the first year of the study will be based primarily on existing data sources and limited analysis. During the second and third years of the study more detailed studies will be conducted. The purpose of these studies will be to upgrade the data, analysis and evaluation for the most promising projects identified during the inventory. Major emphasis will be given to confirming the reliability of data and analysis associated with the hydrology of the project, economic feasibility, environmental and social impacts, marketability of the power, and compatibility of the hydropower development with other water requirements in the region or project area. Detailed specifications for these studies will be developed later and will depend largely on the number of projects carried forward from the preliminary inventory.

Separate Studies of Hydropower Potential. Certain topics will not be handled on a site-by-site analysis basis. These topics include pumped storage, reallocation of storage, modification of project operation, potential for uprating existing units, and an assessment of the national small-scale hydropower potential. Only the assessment of small-scale hydropower potential will begin during FY 1978. Work plans for the other special studies will be developed later.

The special study on hydropower potential associated with low-head generation technology is required by the legislation authorizing the National Hydropower Study. The special study will evaluate the state-of-the-art in order to properly assess the potential of bulb turbines and other low-head turbine

generators. Information will be developed on cost, efficiencies, operating characteristics, and other technical performance data. Based on the results of this study, guidelines will be developed for use in conducting a comprehensive survey of potential low-head hydroelectric installations.

In addition to the physical inventory of hydropower potential two other activities will be carried out under the National Hydropower Study. The second activity will focus on analysis of existing forecasts and projections of energy demand and possible alternative projections based on future energy policies and technologies.

The third activity under the NHS will include special studies on such topics as technology assessment of low-head hydropower, hydropower marketing policy, hydropower potential at existing small dams and hydropower potential by re-allocation of storage.

In addition to the National Hydropower Study, the Corps of Engineers' Institute for Water Resources is engaged in several activities specifically for DOE's small hydro program.

First, in order to contribute to DOE'S "resource assessment," the Corps is refining and expanding its 1977 inventory of existing dams. Instead of a statistical approach on a basin-by-basin basis, the new study will be site-specific. Using Corps and FERC lists, the Corps will recompute the power potential at each individual site and break it down by dam, basin, state, etc. This inventory is "partially" funded by DOE since information from the Corps' National Hydropower Study will be used to improve the inventory.

DOE is completely funding a Corps project to compile a "guide manual" for conducting feasibility studies for small-scale hydro projects. Despite the fact that this effort will not be able to contribute to the feasibility studies recently awarded by DOE (since appendices will be submitted in November 1978 with the final report due in early 1979) the purpose is to provide assistance to future developers. Appendices to the study will detail such topics as hydrological analyses, how to investigate structural integrity of dams, physical facilities, electrical-mechanical design, and economic and financial feasibility. In addition two case studies will be included to illustrate how a feasibility study is conducted in practice.

Finally, the Corps recently completed a special study for DOE (funded by the Corps) to identify 100 promising sites (two per state) for potential development. State water resource officials in each state were contacted in order to come up with this list.

STATE AND REGIONAL PROGRAMS

In addition to the above Federal programs several states have initiated

programs. These states are mostly located in the Northeast where electricity costs are high and old dams are abundant. As the feasibility of small hydro for electricity generation is demonstrated, other regions may become more involved in this area. For the purposes of this report, however, programs in New York are summarized, as well as recent studies done for the state of New Hampshire, the New England River Basin Commission, and the nine states of the Northeast region of the United States.

New York State

In June of 1977 New York State Energy Research and Development Authority (NYSERDA) contracted with the Center for Regional Technology of the Polytechnic Institute of New York to conduct two studies on small hydropower: (1) to produce an inventory of all existing dams whose potential was at least 50 KW and (2) to select up to 20 representative sites and examine them in greater detail to uncover the institutional, financial, environmental and legal problems associated with each type of site. This work is well under way and an inventory listing 1500 sites has been published. New York State has on record over 6300 dams. In addition Polytechnic has received either by phone or mail the names and locations of several hundred others that do not appear on any list. Phase II of this project consists of the selection of up to 20 representative sites to be investigated in greater depth. The work to screen down the randomly selected sites is now under way. The Center's field team consists of experts in the field of hydroelectric generation, dam construction, site geology, environment, sociology, plus support staff. The studies of selected sites will be complete by August 31, 1978.

In addition NYSERDA also retained the Center to help prepare applications for feasibility studies as sponsored by DOE out of Idaho Falls (See above, page III-7). Eight such proposals were prepared and submitted. The Center was given the responsibility of meeting with all parties to each proposal (NYSERDA, the site owner, the Center and the engineers), ironing out differences and certifying to NYSERDA that all proposals were properly completed. In addition NYSERDA has further retained the Center to oversee the feasibility study work on the four proposals that have been funded by DOE as well as following the progress of one successful proposal submitted by Niagara Mohawk independent of the State.

It is clear that the New York State Legislature is taking the redevelopment of small scale hydropower seriously. An allotment of \$500,000 has been made by the Legislature to the Institute for the work to be done principally in the small hydropower field. This is in addition to any other money NYSERDA wishes to spend.

NYSERDA is not the only entity within New York State that has developed a lively interest in small scale water power. The Army Corps is conducting an assessment as is the New York State Electric and Gas Company. This private utility, which at one time operated numerous hydroelectric sites, is once again looking to redevelop both its previously retired sites and open new ones. Their first steps at this time are cautious. However the Power Authority of the State of New York is not so timid. This authority has been likened to the state's TVA. It produces power to be sold wholesale to the private utilities and to governmental units. The Power Authority has up to now operated only two hydro sites: Niagara Falls and the Moses Dam on the St. Lawrence Seaway. Using the inventory developed at the Center, they are seeking other suitable sites, particularly those located on municipal water supply systems. The Power Authority has presently contracted work to Tippetts-Abbett-McCarthy-Stratton to do the feasibility studies on installing hydroelectric generation on two New York City aqueducts.

Niagara-Mohawk is the largest private utility in New York in terms of the size of its service area. It is perhaps one of the leaders in the redevelopment of small hydropower. One year ago they announced a \$200 million program over 15 years to bring back on line 200 MW of power at 15 sites. As mentioned before, NYSERDA has received 4 awards from DOE to perform feasibility studies. These sites are:

- (1) Lake Placid: the site of the next winter Olympics has two sites as part of a cascading system. Together they have a potential of 500 KW.
- (2) Watervliet: a small city north of Albany is now using water power to drive pumps that operate its municipal water supply system. A 1200 foot penstock delivers 90% of the water to drive the pumps and 10% is used for human consumption.
- (3) Croton Falls: this is an old mill now declared a local historical landmark. It once produced hydroelectric power and now has recently been converted to produce cellulose insulation. The site is located on an outlet to the New York City water supply system and is guaranteed a flow of 47 cubic feet/second (cfs). Often the flow exceeds this minimum.
- (4) High Falls: an old utility site owned by Central Hudson who now is looking to study its potential for redevelopment. It once was rated at 1.1 MW and the civil works are entirely intact with the exception of a plugged penstock.

In addition Niagara-Mohawk has been awarded one proposal to study the redevelopment possibilities at Little Falls, N.Y. This site once belonged to them and produced power. Many years ago it was abandoned and turned over to the town. This site lies on the Mohawk River which parallels the Erie Barge Canal.

New Hampshire

The State of New Hampshire convened a commission to study the potential of small hydro development. The commission, in their report, concluded that:

If all retired hydroelectric stations listed in the report were developed, the additional electric power capacity available would be 51,000 KW. Estimated annual generation would be 250 million KWh. At present per capita rates of consumption this additional capability might, at times when available, satisfy the general electrical power requirements of about 40,000 people in New Hampshire, thereby saving about 430,000 barrels of oil each year. These considerations argue strongly for reactivation.²²

New England River Basin Commission

An ad hoc committee was formed to produce a report for the New England River Basin Commission on the potential of undeveloped hydropower in New England.²³ The report noted that New England is even more dependent on expensive, imported fossil fuels than other sections of the country and at the same time may not be developing its full potential of hydropower. Among the committee's findings are that there are 18 sites with a benefit-to-cost ratio between 0 and 1.0 which merit further study. The installed capacity of these sites, if developed, would be 1,805,000 KW with a total construction cost of \$1.42 billion. Sixteen of these plants are in Maine and New Hampshire and one each is located in Massachusetts and Connecticut.

Other conclusions of the report are:

There is an estimated number of some 800 small dams in New England that have previously been utilized for power generation but are now in varying degrees of disrepair or if not previously used for power generation may have power potential. There has been an increasing awareness of these and interest in restoring or developing them. The thought has merit and should be explored. The generating capacity of each would be small, averaging in the range of 200 to 500 KW. Assuming that 30% might be developed, the total capacity could amount to 85,000 KW. Cost and average annual output are not

ascertainable pending further study. This power could possibly be used for street lighting, municipal buildings, and light industries.²⁴

The committee recommended that the New England River Basin Commission undertake an in-depth study of hydroelectric power in order to begin to alleviate the impacts of future cost increases of fossil fuel.

Northeast United States

At the request of the Allis-Chalmers Hydro-Turbine Division in York, Pennsylvania in February 1977, the Center for Regional Technology at the Polytechnic Institute of New York prepared a regional marketing assessment of potential for hydro-power development at existing low-head dams in the Northeastern United States. Nine States were included in the study: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania.

The Center concluded that a definite market exists for low-head hydroelectric technology in the nine Northeastern States. After office and map studies reviewed approximately 5,300 existing dams with useful information, the site inventory yielded approximately 1,600 existing low-head dams (with heads from 10 to 45 feet) which are estimated to be capable of producing hydroelectric power within the range of 50 to 5,000 KW potential.

FOOTNOTES

SECTION III

¹Dick Kirschten, "Hydropower -- Turning to Water to Turn the Wheels," National Journal, Vol. 10, No. 17 (April 29, 1978), p. 672.

²Ibid.

³Ibid.

⁴Summary of Conference Agreement on the Public Utility Energy Policies Act, H.R. 4018, P. 9.

⁵Fact Sheet on Durkin Low-Head Hydro Programs Enacted in 1977, Senator John Durkin.

⁶Ibid., p. 2.

⁷Summary of Conference Agreement, pp. 3 and 9.

⁸Quoted in Kirschten, p. 672.

⁹Ibid., pp. 672-673.

¹⁰Department of Energy, Idaho Operations Office, Program Research and Development Announcement, "Feasibility Determination of Low-Head Hydroelectric Power Development at Existing Dams" (PRDA ET-78-D-07-1706), p. 1.

¹¹Ibid.

¹²Department of Energy, Idaho Operations Office, Program Opportunity Notice, "Low-Head Hydroelectric Power Demonstration Projects" (PON ET-78-N-07-1711), June 23, 1978, p. 1.

¹³Ibid.

¹⁴Ronald A. Corso, Federal Energy Regulatory Commission, "Small Scale Hydro Development: Institutional and Legal Problems," speech to the Low-Head Hydroelectric Technology Seminar, sponsored by the Department of Energy at the University of Idaho, June 6-7, 1978, p. 1.

¹⁵Federal Power Commission, Hydroelectric Power Resources of the United States: Developed and Undeveloped, January 1, 1976 (Washington, D.C.: Federal Power Commission, November, 1976), p. III.

¹⁶Ibid.

¹⁷Richard Corrigan, "The FPC Gets a New Life, New Name and New Responsibilities," National Journal, Vol. 9, No. 43 (October 22, 1977), p. 1649.

¹⁸Corso speech at the University of Idaho, p. 10.

¹⁹United States Department of the Interior, Bureau of Reclamation, Report on the Western Energy Expansion Study (Washington, D.C., February, 1977), p. 1.

²⁰Ibid., p. ii.

²¹David Howard Davis, Energy Politics (New York: St. Martin's Press, 1978), Second Edition, p. 151.

²²State of New Hampshire, Governor's Commission on Hyrdo Electric Energy Report (April 1977), p. 1.

²³New England Federal Regional Council, Energy Resource Development Task Force, Hydroelectric Facilities Work Group, New England Hydroelectric Development Potential (June, 1976).

²⁴Ibid., pp. 2-3.

IV. ENVIRONMENT AND SAFETY CONSIDERATIONS

There is fairly widespread agreement among governmental and environmental representatives that the rehabilitation of existing small dam sites poses almost no threat to the ecology or environment. The Johns Hopkins' study on institutional barriers to small hydropower development for DOE canvassed individuals of several environmental groups* and found that:

Almost unanimously these individuals felt that run-of-the-river operation at existing dams would cause "no difficulty" or was environmentally benign.

A dam designed for peaking power operation that would result in raising and lowering water levels in the river or in a reservoir, however, could be more disruptive.

At a DOE-sponsored seminar on small hydropower in New Hampshire in 1977, a panel was set up to assess potential environmental and safety impacts of both retrofitting old dams and building new dams. The panel concluded that "low-head hydroelectric operations offer a minimal long-term disruption of river and stream environments."² However, there are important issues which must be addressed before concluding that any specific site will not damage the environment. The rest of this section is excerpted from the Environment and Safety Panel report of the New Hampshire seminar and is included in order to point out what these issues are.

Environmental Concerns

The aspect of fish passage, the panel wrote, is the most important environmental concern of small hydroelectric facilities. Because of its small physical size and relatively non-polluting operation, these hydro facilities should not be a threat to plants or mammals near the site. Nor should small hydro cause any major problems with surrounding communities. Fish passage was the one area of major concern expressed by the panel.

The solution of fish passage would have to be based on a regional study which would indicate the most appropriate method to incorporate into the dam structure such solutions as fish ladders or fish elevators. This pertains to both retro-fitted and new dam sites.

The development of a new dam site does pose more environmental problems than the retro-fitting of a previous structure. Land use, water, impoundments, dissolved oxygen, nitrogen, alterations in stream, and toxic materials during construction are all factors that are more prominent in new dam development than in retro-fitting.

*New Hampshire Environmental Coalition, Conservation Society of Southern Vermont, Audubon Society of New Hampshire, Sierra Club, American Rivers Conservation Council, Environmental Policy Center, National Wildlife Federation.

It is important to note that the above panel conclusions were made with the understanding that the operation of the dam would be run-of-the-river for base-line production. If these dams were designed for peak power production, the resulting water shed disturbance could have more far reaching and dangerous environmental impacts.

Although the retro-fitting of old sites appears to be generally of less environmental consequence, the problem of silt build-up behind the dam over a period of inactive years could be a major concern. Methods to deal with the removal of silt should, once again, be based on a specific site appraisal. The silt should not be flushed through the sluice gates if a great amount exists.

Environmental Assessment

The panel concluded that a generic evaluation of potential sites on a national level would be futile. The factors of terrain, fish passage, archeological or historic value, community co-existence, and the important differences between retro-fitted and new sites make it impossible to obtain useful generic guidelines.

Site-specific baseline data, the panel wrote, would be the most accurate method of environmental appraisal. This data would be generated by monitoring environmental factors prior to and during operation. In the case of a demonstration site, this procedure could be followed to obtain data relevant to other future sites in the region. Because regional conditions vary, all policy decisions arising from a demonstration, however, would only pertain to the particular area of the demonstration.

Safety Concerns

New sites have distinctly different safety problems from retro-fitted sites. With a new site, the quality and safety of the structure are insured by the construction standard of the American Society for Civil Engineers (ASCE). On the other hand, assessing the structural stability and safety of a site designated for retro-fitting can be extremely difficult. In order to provide a standard of safety in retrofitting projects, guidelines may have to be established for developers.

As in environmental concerns, the size of the dam is directly related to the potential hazard. Any guidelines established should take different size requirements into account.

Occupational Safety and Health Administration (OSHA) standards are applicable to the developers, operators, and employees of small hydro-electric sites. If maintained, the panel felt that these standards would provide adequate personal safety measures.

Liability of the owners of a dam is an area of safety that blends into the legal aspects of site development (See Section V, page V-9 on "Insurance Availability"). Because of the potential danger to downstream property posed by an ill-maintained dam, existing safety regulations in maintenance should be rigidly enforced to provide maximum protection from dam failure.

Because of the site-specific nature of hydropower development, general guidelines would be very difficult to use. The Johns Hopkins' study includes a partial list of environmental organizations and governmental agencies that might assist in assessing environmental impact.³ This list appears in Appendix F.

FOOTNOTES

SECTION IV

¹The John Hopkins University, Applied Physics Laboratory, Problems in Redevelopment of Old Hydroelectric Power Dams, Second Report on New England (Laurel, Maryland: The Johns Hopkins University, February, 1978).

²Low-Head/Small Hydroelectric Workshop, sponsored by the Department of Energy, University of New Hampshire, Durham, New Hampshire (September 6-9, 1977).

³Johns Hopkins University, p. 28.

V. INSTITUTIONAL BARRIERS TO SMALL SCALE HYDROPOWER DEVELOPMENT

Institutional factors are often cited as the primary impediments to the development of small scale hydropower. This section considers four such issues: utility company attitudes toward small hydro; licensing and other regulatory requirements; insurance availability; multiple usage; and, ownership of dams.

Utility Companies

The barriers to hydropower development revolve around the concept of centralized vs. decentralized power production. The conflict arises from the issue of who should use and develop the small sized dams.

The utilities feel that they, if anyone, should have the option of controlling small hydroelectric dams since it would be reasonable to assume that the utility would have to buy the excess power produced. The utilities demand "total control" because of their concern that power from small dams will not be able to meet peak customer demands. A dam is of no use to them unless it can be brought "on line" at a moment's notice; if the utility does not own the dam the possibility of the owners' inability to bring the dam on-line during peak loads could disrupt service to the utility's customers.

As an example of utility interest in small hydro, the Niagara Mohawk Power Corporation is the most advanced New York utility concerning hydroelectric development (presumably so since they own the most dams in New York State). Niagara Mohawk has owned and/or operated hydro generation representing 660 MW.¹ They plan by 1991 to re-open 15 abandoned power dams ranging from 1.4 MW to 25 MW with the total development program capacity of 205 MW. The Granby Project will consist of a completely new 10,000 kilowatt powerhouse installation² and will be operating by 1981.

The problems encountered with utility or centralized hydroelectric production however, are two-fold. First, roughly half of any electric bill represents fixed distribution costs needed to pay the overhead of a sprawling energy system: transmission lines, transformers, cables, meters and people to read them, planners, headquarters, etc. For electrical and some fossil fuel systems, distribution accounts for more than one-half of the total capital costs. Local or decentralized energy systems can reduce or even eliminate these infrastructure costs.³

A second problem is that a centralized grid increases the likelihood and magnitude of malfunctions, mistakes and deliberate disruptions. A small fault or a few discontented people could turn off a country.⁴

Despite these problems, utility companies maintain that the development of small-scale hydropower will be best realized within the centralized power system concept. Since low-head dams have intermittent power production during both summer (due to the dry season) and winter (due to freezing), the peak demand seasons for utilities, small-scale hydroelectricity would contribute little to the utilities' ability to serve its customers. If a decentralized system were set up in which municipalities or cooperatives generated power for local use, however, the potential of small hydro generating capacity could be better utilized. The central problem that remains is how to provide enough power to meet peak demands.

It is interesting to note here that while most utilities have not been actively developing the small-scale market, they have been crucial in deterring "outside" developers. In a series of Op-Ed articles in the New York Times, a Rev. G.H. Jack Woodard pointed out that an "entire creek bank had been bought by a New York Power Company (Niagara Mohawk) and resold with a deed restriction prohibiting forever the use of the property for the generation of electricity."⁵ He further claimed that : "hydroelectric power generating installations exist which are deliberately not being used..."⁶ In reply, James Bartlett of Niagara Mohawk, claimed that "by retaining such rights, Niagara Mohawk is protecting our ratepayers wherever nominal hydropower of the past may become important for customers in the future."⁷ Rev. Woodard did not accept that and wrote back, "protecting them (customers) from what? What else than the formation of electric power cooperatives..."⁸

If a low-head development is to expand, cooperation with utilities must be achieved. A letter from Bruce G. Goodale to Dennis A. Rapp, both of the Public Service Commission, sums up the situation:

Niagara Mohawk's position is legally defensible, but is deplorable from a public interest viewpoint. If it were Niagara Mohawk's intent to develop the hydro potential of the stream in question the argument about serving their rate-payers would be valid. However, no one really benefits if the resource remains un-utilized.⁹

Licensing and Other Regulatory Requirements

One of the most often heard complaints by potential developers of hydro power is that there are interminable delays in obtaining licenses from the Federal Energy Regulatory Commission (FERC; formerly, the Federal Power Commission). At a seminar sponsored by DOE on small hydropower in 1977, one participant noted that:

The biggest barrier from an economic point of view to entry by industry, but more importantly by the small individual who is interested in the developing hydro-electric project, is the enormous up-front expense involved: conducting an engineering feasibility study, preparing applications, and actually going through the licensing process, assuming he can find out what those licensing requirements are.¹⁰

Using standard FERC procedure, 12 to 15 months is required to issue a license for a small scale hydro development. If an environmental impact statement (EIS) is required, the procedure would take another ten months. In a recent speech, an official of the FERC¹¹ outlined the licensing procedure. The following review of the FERC licensing process is excerpted from his speech and is intended to illustrate the very real regulatory problems small hydro developers face.

The FERC is authorized to license non-Federal developments that (1) occupy in whole, or in part, lands of the United States; (2) are located on navigable waters of the United States; (3) utilize surplus water or water power from a government dam; and (4) affect the interests of interstate commerce. Court interpretations of the Commission's jurisdiction have defined this authority so that it covers virtually all projects.

A developer can follow one of two different procedures: apply to the Commission for a preliminary permit (Permit) or a license. Although a Permit is not a necessary prerequisite to an application for a license, it can be important to a potential developer since a Permit, during its term, provides sole authority to develop a site or, in other words, priority to file an application for license. A Permit thus protects the substantial investment that is made in feasibility studies and license application preparation, because it precludes development by others.

There are several institutional and legal problems associated with a Permit. First, under the Federal Power Act, public entities are given preference to power sites. Section 7(a) of the Act gives priority to public entities, provided they have filed an equal application or can revise any application it has filed to make it equal to one filed by a non-public entity. This naturally generates public/non-public controversies. Under the Act, Rural Electric Cooperatives (Coops) have the same status as private entities. This preference clause has resulted in some very interesting controversies. For instance, in Vermont there are on file Permit applications for sites with Coops versus public entities, and public entities versus private utilities. If competing public and private entities file for the same site and the applications are equal, the public entity automatically obtains the Permit, regardless of when the applications are filed. If the applications are not equal, the Commission would then issue the Permit to the applicant that proposes the project that best

fits the plan for comprehensive development of the river basin, pursuant to Section 10(a) of the Act. If the competing applicants are either both private or both public entities and the proposals are equal, then the party filing earliest would be awarded the Permit. Obviously, the number of combinations are many. With the new interest in hydro development, there are an increased number of competing applications causing long delays because extensive additional legal and technical analyses are necessary before a Permit can be issued.

One final note regarding Permits should be mentioned. If a developer needs to make field investigations, which is likely, he would need to obtain permission to enter upon private or U.S. lands to conduct subsurface explorations, gather engineering and environmental data, and perform surveys and mapping. Permission to enter private lands does not usually cause insurmountable problems because developers are able to negotiate with private land owners. On Federal lands, a developer may need to obtain a permit under the Federal Land Policy and Management Act to enter upon the lands. If the Federal land agency does not act promptly, or contends that studies or environmental assessments are necessary, long delays will necessarily follow.

The FERC official then focused on the problems associated with obtaining a license. The license processing steps that are discussed below are also followed by the FERC in processing a Permit application.

Assuming a potential developer has obtained a Permit, he may file an application for license during the term of the Permit with the security that there will be no competing applicant. If, however, a potential developer decides to file an application for license without a Permit, there would then be the same risks as with a Permit of a competing application for the same site. Again, the same preference rules would apply regarding the public versus Cooperative or private applicants. However, because the license application stage involves greater and more far reaching issues, it is most likely that, if there are competing applications, the Commission would require a hearing before making any final determination. A hearing would involve the following issues: (1) adequacy of design; (2) economic feasibility; (3) environmental impacts; (4) financial capability of applicants; (5) availability of power market; (6) dam safety; (7) project's adaptability to comprehensive development of the river basin; (8) potential for federal development; (9) water rights; and (10) other pertinent matters.

A hearing can be an expensive and protracted proceeding, sometimes resulting in months or years of delay. Potential developers of small scale projects are strongly urged to avoid a hearing if at all possible.

If there are no competing applications, a hearing may be required if there is opposition to the project or its proposed operation. Hearings

on hydro projects are usually related to environmental issues. For small scale developments, the most probable reasons would be water quality or fishery matters. For instance, in many states fish and game agencies routinely intervene on every application for license to protect interests, sometimes undefined. For small scale developments, FERC anticipates some problems, particularly in those areas where fish facilities may be required.

After discussing the preliminary stages of the licensing procedure, one can discuss how an application makes its way through the FERC procedures. These procedures have evolved over many years and are a result of requirements of the Federal Power Act and, more particularly, other legislation enacted by Congress. The following is a list of some of the other more important statutes affecting the licensing process:

- National Environmental Policy Act (P.L. 91-190)
- Fish and Wildlife Coordination Act (P.L. 85-624)
- Endangered Species Act (P.L. 93-205)
- Historic Preservation Act (P.L. 89-665)
- Water Pollution Control Act (P.L. 92-500)
- Water Quality Improvement Act (P.L. 91-241)
- Wilderness Act (P.L. 88-577)
- Wild and Scenic Rivers Act (P.L. 90-542)
- Coastal Zone Management Act (P.L. 93-612)
- Federal Land Policy and Management Act of 1976 (P.L. 94-579)

The effect of these statutes on a developer occurs at three stages: (1) pre-license application; (2) during the licensing process; and (3) after issuance of the license. Briefly, here are some of the problems a developer encounters from these statutes.

The greatest problem with the National Environmental Policy Act (NEPA) is not compliance, but over-compliance. FERC has found that every agency at the State and Federal level is doing NEPA assessments or statements before making decisions. This results in delays in FERC receipt of agency comments or other permits and licenses required from State and Federal agencies. For small scale developments, there is a need for cooperative efforts to reduce this over-compliance. A lead agency must be recognized to meet NEPA requirements. Although the lead agency concept is accepted at the Federal level, some agencies do not follow it. Therefore, there is considerable duplication of effort. At the State level, state agencies will sometimes recognize Federal NEPA impact statements. They will not, however, recognize an assessment or negative determination. On the other hand, Federal agencies do not recognize any State environmental assessments or statements prepared pursuant to State laws. The solution is to expand the lead agency concept to both the Federal and State agencies.

The Fish and Wildlife Coordination Act (FWCA) requires the FERC to consult and cooperate with Federal and State fish and game agencies in two ways.

First, each application for license must include an Exhibit S, a fish and wildlife plan. FERC regulations require that an Exhibit S be developed in consultation and cooperation with the agencies. It should be emphasized that an Exhibit S is the developer's plan. Agency input is not for the purpose of dictating the contents of the plan, but to provide assistance and guidance. After the application for license is filed, fish and game agencies are requested to comment on the plan. If there is disagreement on the adequacy of the Exhibit S, as often occurs, then the FERC must resolve the differences. This is done through meetings or conferences, further correspondence, or formal hearings, all of which require time. For small scale developments, FERC is optimistic that the problems will be small, too. The greatest problem anticipated is the possible requirement for construction of expensive fish facilities that could preclude economic development.

The Endangered Species Act places a responsibility on the FERC to assure that development will not interfere with or destroy any endangered species. Since the FERC is a regulatory agency and not a constructing agency, it requires each applicant to determine if a proposed development affects any endangered species. The FERC also specifically requests the Department of the Interior to comment on this matter. The impact of this statute on small scale hydro development is indeterminable at this time, according to FERC.

The Historic Preservation Act has resulted in some special problems for small scale developments because the proposed project may itself be an historic landmark. Before the FERC can issue a license, the Advisory Council on Historic Preservation and the State Historic Preservation Officer must be consulted to assure that no historic or cultural site will be adversely affected. Exhibit V of a license application requires applicants to consult with these agencies, and the FERC also requests agency comments on the application regarding this statute.

Water quality statutes are a very important consideration for any potential developer. Pursuant to Sections 401 and 404 of the Federal Water Pollution Control Act Amendments of 1972, approvals from the Environmental Protection Agency (EPA) and the Corps of Engineers, respectively, are necessary. EPA has delegated to most states its Section 401 responsibilities. Section 401 requires certification that a development meets state water quality criteria. This is usually done by imposing minimum flow requirements which are included as license requirements by the FERC. Placing fill or any material in a stream requires a Section 404 Permit from the Corps. Therefore, a permit is required for construction of a powerhouse at an existing dam. If recreation facilities or other facilities requiring sewage treatment are included in a development, a developer may also be required to apply for a Section 402 permit (NPDES Permit).

The obvious problem lies with minimum flow requirements. Minimum flows to assure compliance with water quality standards could render some small scale developments uneconomical.

The impact of the Wilderness Act and the Wild and Scenic Rivers Act is obvious. Any proposed development in a Wilderness area or on a potential Wild and Scenic River is unlikely to succeed. The Coastal Zone Management Act does not present significant problems because few hydro developments affect coastal areas.

The Federal Land Policy and Management Act (FLPMA) presents some special problems for projects located on Federal lands. The Departments of the Interior and Agriculture (U.S. Forest Service) are responsible for administering this statute. As of the June 1978, final regulations had not been issued by the agencies. Dependent on how the regulations are structured, FLPMA could be, on the one extreme, a duplication of most of the FERC licensing requirements, or on the other extreme, a supplementary requirement to assure protection of Federal land resources. The FERC has urged the agencies to implement regulations that minimize the duplication of efforts and reduce the filing requirements of applicants for projects on Federal lands. The full impact of FLPMA cannot be assessed until the agencies publish their joint regulations.

In his speech, the FERC official concluded that these numerous statutes:

... have resulted in overlapping and conflicting authority over hydro developments. The absolute solution to resolving overlapping or conflicting authorities requires legislative changes. In other instances, agency cooperation and constructive regulations could reduce the problems without compromising the intent of other legislative authority. These solutions do not appear to be forthcoming.

A step-by-step explanation of the FERC licensing process indicates the length of time involved before a license can be issued.

When an application is filed, the first step is an FERC Staff review to assure compliance with the FERC regulations. If there are deficiencies, a deficiency letter is sent to the applicant requesting a revised application. After the application is complete, or if not found deficient under the initial review, the applicant is requested to provide additional copies (usually 50 to 75) for circulation to Federal, State, and local agencies. It requires 60 to 160 days to reach this point, dependent on the extent of deficiencies in the application. Agency comments are usually requested within a 60 to 90 day period. FERC experience with agencies' comments has not been good. Delays are normally encountered at this point because of late agency responses. After all agency comments are received, the applicant is given an opportunity to comment on the

agency responses. This usually requires 30 to 50 days. At this point, the FERC Staff will make a final determination on whether or not an environmental impact statement (EIS) is required. Staff does this by reviewing the application and agency comments, and by conducting its own analyses. If an EIS is not required, Staff would complete its technical analysis and prepare recommendations to the Commission. This usually requires three to four months.

If an EIS is required, a draft EIS is prepared, usually four to five months after receipt of final agency comments. Federal Guidelines and FERC regulations require a 45 day comment period on a draft EIS, but experience indicates that this period could be as much as 75 days. After comments on the draft, EIS Staff prepares and circulates the final EIS. This usually requires about three months. At this point, the technical Staff is ready to prepare recommendations to the Commission. This step in the licensing process varies with the complexity of the proposed project. The legal Staff would then prepare an order for final Commission consideration. The usual time required for issuance of a license for a small scale development is about 12 to 15 months, assuming no EIS is required. If an EIS is required, it would require an additional ten months.

Given this fact, FERC has decided to deal with licensing problems by attempting to reduce the time required to obtain a license for small hydro developments. On April 21, 1978, FERC issued proposed rule changes to shorten the licensing procedures for small hydro developments.¹² A new application form (the "short form") is proposed in order to provide a simplified procedure and format for processing applications for small-scale hydroelectric projects that meet the following specific size criteria:

- 1) dam height less than 25 feet;
- 2) reservoir impoundment surface area of less than 10 acres; and
- 3) capacity of less than 1,500 kilowatts.

These criteria were chosen because they represent lower limits in applicability of existing rules from other statutes. First, according to the National Dam Inspection Act, dams of less than 25 feet in height "would likely be in a low hazard category." Second, when the maximum surface area of the impoundment is less than 10 acres, Federal and State fish and wildlife agencies need not be formally consulted pursuant to the Fish and Wildlife Coordination Act. Finally, the FERC's current regulations (resulting from the Federal Power Act) require considerably less detail for projects of 2000 horsepower (1,500 kilowatts) or less. It is evident that these restrictions will exclude many small dams. However, for those that do qualify the short form (compared to the present regulations) would lessen the descriptive information needed, reduce the details required on maps and drawings, and simplify the requirements for complying

with the National Environmental Policy Act. The proposed rule is included in Appendix G.

As noted above in the explanation of licensing procedures, approval by state authorities is important on such issues as fish and wildlife plans, historic landmarks, and environmental impact statements. Requirements for licenses at the state level varies, however. For example, the New York State Public Service Commission has no laws or policies governing generation of hydropower for sites under 50 MW. In New Hampshire, a developer must inform the New Hampshire Water Resources Board (WRB) of his intent to construct or redevelop a dam "10 days prior to construction." The WRB has the power to call a hearing on the proposed activity to "consider the effect upon scenic and recreational values, upon fish and wildlife, upon the natural flow below the dam, and upon any and all hazards to other public uses."¹⁵

The impact of these various regulations is to compound the complexity and length of time required to begin construction. Coupled with the Federal regulations explained above, it is not difficult to comprehend the numerous complaints about present licensing procedures.

Insurance Availability

The cost of premiums for insuring investments against loss and liability of dams may be "the number one deterrent to development of small hydro projects", according to one FERC official.¹⁴ In New Hampshire, the Governor's Hydro Electric Energy Commission¹⁵ on the potential of small hydropower for that state addressed the problem of obtaining liability insurance. The Rowley Agency, Inc., on behalf of the Commission, inquired of approximately 15 insurance company markets what their positions were regarding dam liability. With the exception of one, all the responses expressed no interest in providing insurance coverage on redeveloped hydro sites (See Appendix H for examples of replies). The one company which did respond positively outlined a conservative position involving much time and expense.

Given these responses, the Rowley Agency concluded that:

... the acquisition of high limit liability insurance protection for such hydro-sites, would, at best, be a very long and exhausting procedure, and would involve significant premium expenses if the owner-operator were successful in attracting the interest of the (apparently very few) company markets who offer this kind of coverage.¹⁶

Despite the pessimism of these findings, one important fact must be considered. Neither the FERC nor state regulations require a public liability insurance program as a precondition to the issuance of a license.

One option, then, would be to forego obtaining insurance altogether. Such a choice would carry substantial risks, however, both for the developer and the public at large.

The John Hopkins University study on institutional problems in small hydro development offers a partial solution. To insulate their investments to some degree, developers could form corporate ownerships of dams and their power facilities.

Another solution would be to enact legislation at the state level to require insurance companies to provide such coverage. By mobilizing interest at the local level in redevelopment of small hydro sites, the DOE program (see page III-4) hopes to stimulate support for such legislative efforts. It is clear that some solution must be found for this problem.

Multiple Water Use

Abandoned power dams have been developed over the years for alternative uses which may or may not hinder retrofitting dams for power production. Water supply, for most communities, takes top priority. The reactivation of a dam site involved in water storage may be hindered by the town's demand for water. The conflict of interest arises when the demand for drinking water is high and the demand for power is high. A balance may be derived by estimating the towns' peak water demand and assigning the surplus to hydropower production.

The same can be said for recreation, flood control, irrigation and travel. A conflict arises when hydropower production competes for the use of water with the above. Recreation camp owners require that their visitors have enough access to water for fishing, swimming, boating, etc. A farmer requires a certain amount of water per harvest to ensure a successful crop and a barge canal requires a certain water level to allow safe boating.

The benefits that towns, recreation facilities, farmers and transport systems may derive from small hydropower redevelopment however, may be enough of an incentive to set aside their fears. Flow meters can be installed upstream to measure water flow. A gate system by matching water flow to peak water demands can be devised which, operated manually, can divert enough water to a multiple turbine system (one for high flow, one for low flow) to produce power.

Flood control dams, as such, which are participants in the Federal Flood Insurance Program have been excluded from power production. Flood control reservoirs are usually kept almost empty of water so as to leave room in case of floods. Such reservoirs make poor power producers.

Ownership of Dams

A key issue in retrofitting sites is ownership. The owner of record: a) must be identified for licensing and regulatory processing; b) must give permission for site development in order to proceed with the licensing process; c) has all rights to the sale and distribution of power produced by that dam and therefore controls all hydropower development; d) has the ability to sell the land and retain the power rights and vice-versa. An interested developer must have the ability to locate the "owner of record" and receive permission to retrofit the dam.

In going through the Army Corps of Engineers' 90-day report, the Federal Power Commission's 1976 report and other similar studies, one must note that the information is based upon state files, some of which date back at least 60 years in time. Dam "owners of record" may be recorded as early as 1910 without any update (there are no forms required to be filled out for the transfer of dam ownership by any environmental or technical regulatory agency).

To test this theory, the Center for Regional Technology at the Polytechnic Institute of New York performed a random telephone survey in New York State of 75 dams using local tax assessors (at township/county level), the last owner of record, and the utility to the corresponding service area.

The first problem encountered was that in many cases (about 30%) the local tax assessor a) did not have the dam on the tax role or local tax map; or b) could not determine from existing information who owned the dam. In some communities local tax maps had not been constructed and in one case an entire county had no centralized records.

A few companies and state agencies were unsure if they owned the dam or only the water/land rights around it. A paper company said that their rights were south of the dam, the State Park Agency owned the rights north of the dam and the Corps of Engineers maintained the dam but did not own it. Utilities were not quite sure of what they owned or did not own.

An underlying issue to ownership and ownership rights is that municipalities have been given priority in obtaining dam rights/licensing over private developers (see above, page V-3). The CSA, jointly with a municipality, could bid for dam site rights with the assurance that they will obtain the rights over private developers.

FOOTNOTES

SECTION V

- ¹Niagara-Mohawk Power Corporation, "Hydroelectric Development Report," 1977, p. 1.
- ²Ibid., p. 4.
- ³Amory Lovins, "Energy Strategy: The Road Not Taken," Foreign Affairs (October, 1976), p. 79.
- ⁴Ibid., p. 92.
- ⁵New York Times, December 28, 1976.
- ⁶Ibid.
- ⁷New York Times, June 12, 1977.
- ⁸New York Times, February 1, 1977.
- ⁹Bruce G. Goodale, "Development of Small Hydroelectric Sites," February 18, 1977.
- ¹⁰Ronald Zanoni, NH/DOE Seminar p. 5-105 NOT COMPLETE
- ¹¹Ronald A. Corso, "Small Scale Hydro Development; Institutional and Legal Problems," a speech to the Low-Head Technology Seminar at the University of Idaho, June 6-7, 1978.
- ¹²Federal Register, Vol. 43, No. 83 (April 28, 1978), pp. 18196-18205.
- ¹³State of New Hampshire, Governor's Commission on Hydro Electric Energy Report, April 1977, p. 33-34.
- ¹⁴Ronald A. Corso, "Small Scale Hydro Development; Institutional and Legal Problems," speech to the Low-Head Hydroelectric Technology Seminar at the University of Idaho, June 67, 1978, p. 8.
- ¹⁵State of New Hampshire, Governor's Commission on Hydro-Electric Energy Report, April 1977.

¹⁶ Correspondence from William J. Wiley, the Rowland Agency, Inc., to George McGee, Sr., Chairman, Governor's Hydro Electric Energy Commission, March 21, 1977. (Letter reproduced in Appendix H).

¹⁷ The John Hopkins University, Applied Physics Laboratory, Problems in Redevelopment of Old Hydroelectric Power Dams, Second Report on New England (Laurel, Maryland: The Johns Hopkins University, February, 1978), p. 23.

VI. ECONOMIC CONSIDERATIONS

The economics of hydropower generation from small dams are extremely complex. Given high fuel costs and increased capital costs of alternative generating plants, the economic feasibility of small hydro developments may have become more favorable. According to one government official,

If the effects of increasing fuel costs and inflation are considered, the economics of hydropower development become more favorable. For instance, in the New England area plants costing \$1,000/KW or more are considered feasible. In certain areas of Alaska, such as the City of Sitka, projects with a cost of over \$2,000/KW are found to be economical because the alternative is diesel power.¹

Our discussion of economic considerations focuses on two questions: whether electricity generated from small hydro facilities is "economically" useful; and what are the costs and financing problems involved in such developments.

Economic Uses of Small Hydro

Municipalities and industries view small-scale hydropower as a viable alternative to rising utility prices for electricity and natural gas. Since the dam is in the vicinity, little is lost via the energy distribution system. A perfect example would be the proposed Potsdam, New York site (located in St. Lawrence County where 15.07 percent of the population is below the poverty line²) where 1000 KW would provide power for the town's water filtration plant, police station and the hockey rink. Notice that the power from this dam, like most small dams, is not enough to make a town entirely "utility free" and many therefore question the rationale behind investing in the small-scale market.

Two facts should be considered here. First, "a mere 4 percent of delivered energy, represents all lighting, electronics, telecommunications ... which now require electricity".³ Second, over half the energy used in the United States is required for home/business hot water heating. These facts lead to two possible objections against developing small-scale hydropower. First, since the direct electrical requirements are so small, it is not increased electrical production (centralized or decentralized) that is needed but an increase in fossil fuels or alternative "soft" technologies which lend themselves to direct utilization for heating and mechanical motion (cars). Second, since the electrical requirements are so small, the status quo, centralized utilities, should remain as the power distributors.

To answer the second part first, as mentioned in Section V on utility attitudes (see page V-1), the use of electrical distribution grids costs

both electricity and money:

Worse, at least half the energy growth never reaches the consumer because it is lost earlier in elaborate conversions in an increasingly inefficient fuel chain dominated by electricity generation (which wastes about 2/3 of the fuel) and coal conversion (which wastes about 1/3).⁴

By using decentralized power via hydroelectricity, fuel can be saved for direct home heating needs as well as for use in cars.

As for the fact that hydroelectricity cannot be used for home heating and fuel for cars, there is now a possibility of electrolyzing the water that runs through the dam. One of the products that is derived, natural hydrogen, can be used for home heating, by adding it to the existing gas lines of the township, and mechanical motion, by combining the hydrogen with wood to produce methanol which can be burned in cars. Excess hydrogen can be stored in 200 KW fuel cells, which Brookhaven National Laboratory and General Electric expect to be perfected by 1980-1981. Therefore, decentralized use of small-scale hydropower dams can be beneficial in meeting electrical, heating, and mechanical needs of a town and/or industry.

The other argument, which is the main argument against small-scale hydropower development (or any other alternative technology) is: are there cheaper and easier ways to produce or save energy than the aforementioned system?

Obviously conservation, instead of creating new energy sources, saves existing fossil fuels for future use:

The capital savings of conservation are particularly impressive ... investments needed to save the equivalent of an extra barrel of oil per day are often zero to \$3,500, generally under \$8,000, and at most about \$25,000 -- far less than the amounts needed to increase most kinds of energy supply.⁵

Yet the necessity to develop new energy supplies is still present. In terms of priorities, both energy conservation (for near term savings) and new energy supplies (for long term needs) are necessary in order to create a balanced energy plan.

Small scale hydropower is a renewable soft technology which lends itself to quick installation and minimal environmental effects. In a decentralized system it can provide electricity, and heat (via hydrogen in natural gas lines), yet it cannot be heavily relied upon in a centralized power system. It can provide cheap energy as well as mix with other alternate technologies (wind pump storage, solar collectors, co-generation) to form

an independent energy system, since it may not provide enough energy of its own to make a community "energy free."

The case for small-scale hydropower is this: mixed with other technologies to form "energy systems" will bring its greatest utility while total reliance on decentralized small-scale hydropower may or may not be enough for a local community or industry. In either case though, precious fossil fuels will be replaced by renewable energy sources.

Cost and Financing of Small Hydro

The economic feasibility of small scale hydropower is like other independent energy systems, very site dependent. However, there are some general considerations that must be addressed before a site-specific economic analysis is made. Work previously completed in this field has generated a range of costs depending on capacity and head height (See Table VI-1). They have shown that the installed costs of small hydro sites range from a high of \$2000/KW down to \$1300/KW. The smaller site with a lower head is accompanied by higher installation costs. The cost per KW drops as the size and head height increase.

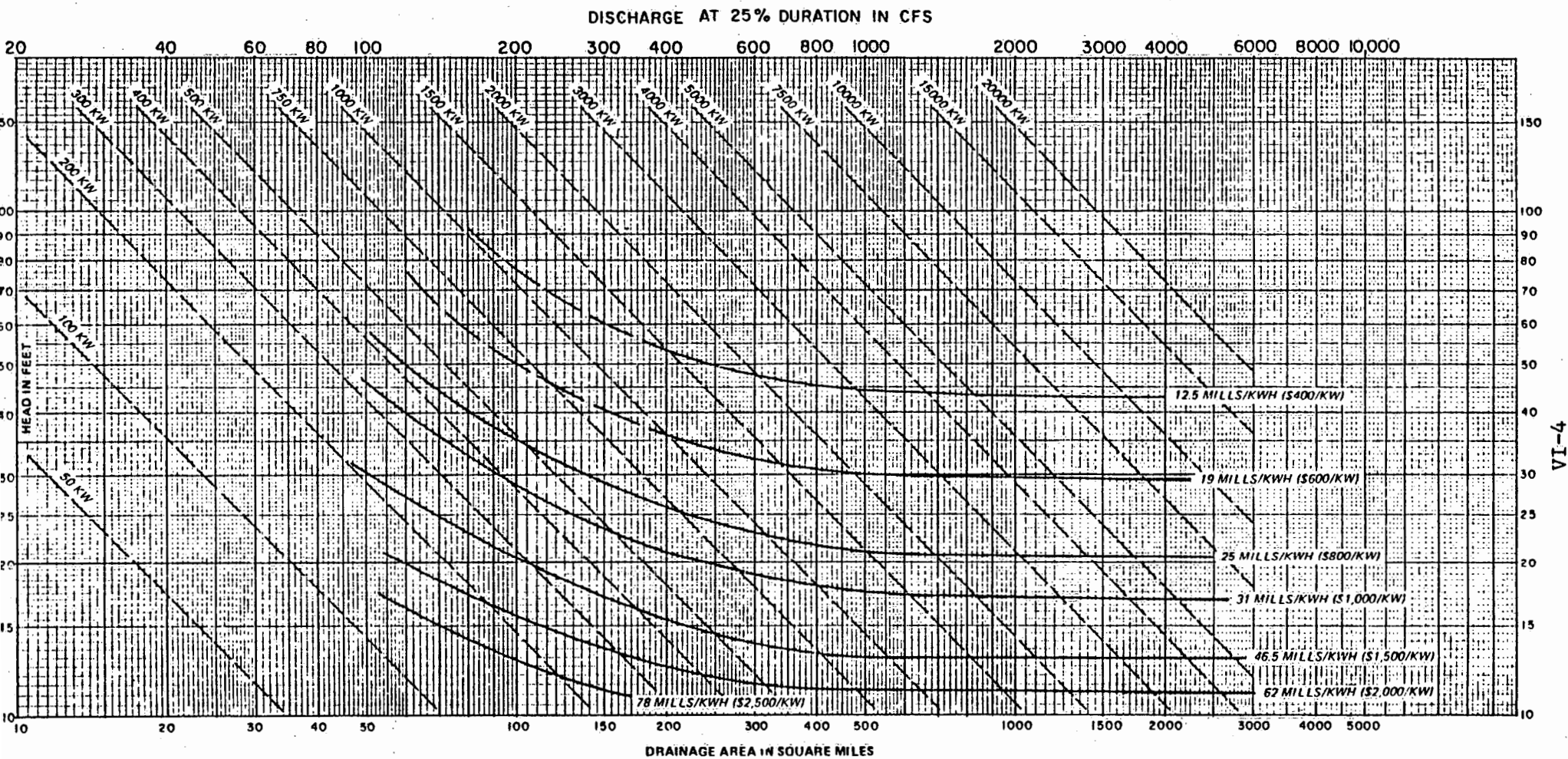
Small scale hydropower sites have been notably absent from plans for construction of hydropower capability. The reasons are simple: the cost of constructing a dam is so high that the additional costs of construction of the power house and installing the generator-turbine make such an undertaking uneconomical. This section, following current Federal and State interest in small hydropower, is concentrating exclusively on existing dams in reasonably good condition. All projected costs are based on this assumption.

A small number of private developers have already started to move into this field. It has become quickly apparent what the financial constraints are going to be. The up-front costs are singularly the most difficult problem. Each hydropower site needs the following items before construction can begin:

- 1) Pre-feasibility study and conceptualization of project:
\$3-5,000;
- 2) Full feasibility study with some pre-construction planning,
drawings and environmental impact statement: \$20-30,000;
- 3) Application to the Federal Energy Regulatory Commission
(unknown cost).

These three steps represent an investment of money that may or may not be returned. Should there be a negative finding at any of the steps, the money spent will be considered "lost." As a result of this, all prospective

TABLE VI-1



From: "Evaluation of Hydroelectric Potential in the Northeast", by Eugene O'Brien, Tippetts - Abbott - McCarthy - Stratton 345 Park Avenue, N.Y., N.Y.

TYPICAL INSTALLED CAPACITY AND MINIMUM ENERGY COST
FOR SMALL HYDRO PLANTS AT EXISTING DAMS
NORTHEASTERN UNITED STATES

(REVISED APRIL 1978)

1/ Rated Installed Capacity
for 2 cfs/square mile.

2/ Annual Energy equivalent to
rated capacity for 4000 hours.

developers have an immediate risky up-front investment. Money for such costs is the most difficult to get and clearly would be difficult to pay back.

Should a site prove technically feasible, economically attractive, and a customer or a use for the power confirmed, then money for venture capital becomes more readily available. The monies available in the future National Energy Act reflect this fact.

The Act provides for \$10 million per year for three years in up-front money to do feasibility studies and licensing application. Such monies will be considered a forgivable loan should the site prove to be unfeasible. In addition, the Energy Act provides for \$100 million per year for 3 years to be used for actual construction.

Municipalities and public power agencies have access to "cheap money" via municipal bonds or industrial development bonds. Private utilities and private developers must go to the normal money markets to seek venture capital. These private interests have found small scale hydropower redevelopment to be most difficult to justify economically. Their special demands for return on investment make for stringent criteria that is not faced by public agencies.

CSA and local community development agencies may very well have a distinct advantage in the redevelopment of small scale hydropower with their access to special funds. The redevelopment of hydropower sites is no respecter of wealth or social status. If a site is attractive to a high income developer, it may be even more attractive to low-income communities.

At this time all private development of small hydropower sites is intimately tied to economic development. That is to say, a site will be dedicated to a specific user of the power. To redevelop a site merely to sell power to a local utility is the least effective use of such a site and least economically attractive. A site, to be attractive, should be used as a source of power for a new or expanded industry. Such an industry would have the additional benefit of being able to provide new jobs. Should CSA become involved, it could use a site to specifically establish a minority or small business. Such organizations would be tied to the needs of the nearby low-income community.

Generalized statements about the feasibility of small hydro sites nationwide are impossible as each site offers distinct opportunities and problems. However, small private entrepreneurs have already made attempts to redevelop small sites. They are finding them attractive. Low-income organizations should find these sites even more attractive.

FOOTNOTES

SECTION VI.

¹Ronald A. Corso, Federal Energy Regulatory Commission.

²Poverty Statistics from the 1970 Census of 1969 Cash Incomes.

³Amory Lovins, "Energy Strategy: The Road Not Taken," Foreign Affairs (October, 1976) p. 78.

⁴Ibid., p. 68-69.

⁵R.A. Fernandes and H.D. Phillips, "Hydrogen Cycle Peak-Sharing on the New York State Grid Using Fuel Cells," Niagara Mohawk.

VII. COMMUNITY SERVICES ADMINISTRATION'S PROGRAM OPTIONS

Having built a massive industrial system on a plentiful supply of inexpensive fuel, the United States has been forced by recent economic and political events to search for alternatives to increasingly expensive fossil fuels. Much attention has been focused on alternative sources of energy which are renewable: the sun, the wind, and water. All seem to be non-polluting, environmentally safe and infinitely abundant.

Using water power to produce energy from small dams, however, has a distinct advantage: the technology has been developed and the dams already exist throughout the country. Economically, producing electricity from hydropower may now be competitive with other sources of energy, such as fossil fuels and nuclear power plants, in some areas of the country.

The Federal government recognizes this fact and has begun numerous programs to encourage development of the many small dams that could be used to produce hydroelectric power. These programs, however, are not targeted to that strata of society who stand to suffer the most from increased fuel and electricity prices: low-income people. This report has illustrated that despite some institutional and economic impediments, generating electricity from small scale hydropower plants is a viable alternative. If it is indeed economically feasible, then there should be an even greater incentive to use it to alleviate the economic strain on low-income communities.

The Community Services Administration has a mandate to "take ... appropriate action necessary to insure that the effects of the energy crisis on low-income persons, the elderly, and the near poor are taken into account in the formulation and administration of programs related to the energy crisis" (Community Services Act of 1974, Section 222(a) (2)). Small-scale hydropower is clearly a source of energy which should be explored in terms of programs for the poor.

Based on the findings of this report, program options for CSA relating to small-scale hydropower fall into two basic categories: support for ongoing programs and CSA action items.

Support for Ongoing Programs

(1) As noted above in Section III (pages III-1 to III-4), there has been much activity in Congress to promote the development of small-scale hydropower. The President's National Energy Plan contains provisions for loan programs as well as regulatory reform.

It is recommended that CSA support Congressional initiatives on loan programs and regulatory reform.

Although wording in the legislation does give some preference to municipalities and small private developers, low-income communities are not specifically mentioned. Therefore, opportunity exists for CSA to insert such language in future legislation not only for loan programs but for Department of Energy authorizations as well.

It is recommended that CSA establish contacts with appropriate Congressional committees to insure that future programs in small hydro development are targeted to low-income communities.

(2) As in all of Federal policymaking, a definable coterie of "insiders" exists throughout the government forming an informal small hydro interagency group. In order for CSA to effectively influence Federal policy with regard to small hydro development, it is essential to become a part of this group.

It is recommended that CSA support the creation of a formal interagency group and actively participate in it to promote cooperation with, and coordination of, the various Federal small hydro programs.

(3) Section V of this report reviewed the regulatory and institutional barriers to small hydro development. Although the Federal Energy Regulatory Commission has taken steps to streamline this process by issuing a "short form" for small hydro license applications, much more needs to be done.

It is recommended that CSA support FERC attempts to simplify licensing procedures beyond the present short form for small hydro sites of less than 1,500 KW capacity.

Because of a plethora of existing legislation which causes interminable delays in the licensing process, Congressional action may be required to exempt small hydro developers from certain regulatory provisions.

CSA Action Items

CSA can directly promote the development of small hydropower for low-income communities in several ways.

(1) There is a definite need for an information program to inform low-income communities that options to high-cost electricity from central grids do exist. By catalyzing action at the local level, CSA can greatly contribute to the growing support for alternative, renewable sources of energy.

It is recommended that CSA set up an information program to inform low-income communities, through Community Action

Agencies, of Federally-supported programs on small hydro and encourage them to participate in such programs.

(2) The "up-front" costs of feasibility studies and license application are the most risky and most difficult to finance. The Department of Energy recently awarded 56 grants for feasibility studies of small hydro sites. The next stage of DOE's program is to award money for demonstration projects. Since feasibility studies must precede applications for demonstration projects, there is a need for support for such studies prior to application to DOE by for any low-income community.

It is recommended that CSA financially support feasibility studies for those low-income communities which are responding to Federal programs.

(3) As an alternative to supporting low-income communities responding to other Federal programs, CSA could consider the option of directly promoting the development of small scale hydropower. Municipalities and public power agencies have access to "cheap money" via municipal bonds or industrial development bonds for financing small hydro development. CSA and local community development agencies may very well have a distinct advantage in the redevelopment of small scale hydropower with their access to special funds -- perhaps to establish a minority or small business. Such development would not only supply cheap power, but could create jobs as well.

It is recommended that CSA consider developing a program to fund, perhaps in conjunction with the Department of Housing and Urban Development (HUD) and the Department of Commerce's Economic Development Administration, small hydropower plants in low-income communities.

APPENDICES

Appendix A	Definitions - Hydroelectric Power
Appendix B	Technical Data State-of-the-Art Explanation of Turbine Technology List of Turbine Manufacturers
Appendix C	Office of Economic Opportunity, Information Center, Community Profile Data Sources
Appendix D	Governors' Replies
Appendix E	Department of Energy Feasibility Awards
Appendix F	Partial List of Groups to Assist in Assessing Environmental Impact
Appendix G	Federal Energy Regulatory Commission "Short Form"
Appendix H	Insurance Company Responses

APPENDIX A

DEFINITIONS - HYDROELECTRIC POWER

- An auxiliary unit is a relatively small unit operated by water power to provide electric service for station use and normally is not connected to the system load.
- A bulb turbine unit consists of an axial flow turbine connected to a generator which is placed in a bulb-shaped watertight steel housing located in the center of an enlarged water passage.
- A conventional hydroelectric plant is one in which all of the power is produced from natural streamflow as regulated by available storage.
- A conventional unit is one that operates only as a turbine-generator.
- Dependable capacity is the load-carrying ability of a station or system under adverse conditions for the time interval and period specified when related to the characteristics of the load to be supplied.
- Head is a measure of potential energy of a fluid. Gross head is the amount of fall, in feet, of the river developed for power. Net or effective head equals the gross head minus energy losses sustained in bringing water to the generating equipment.
- A hydroelectric plant is an electric power plant in which the turbine-generator units are driven by falling water.
- An industrial plant is an industry-owned plant that generates electricity primarily for use by the owner.
- Installed capacity is the total rated capacity of the main generating units as shown by the nameplates for developed projects or as the planned nameplate capacity for undeveloped projects.
- Peaking capacity is generating equipment normally operated only during the hours of highest daily, weekly, or seasonal loads.
- Penstock is a pipe or conduit conveying water to the turbine from a source at some elevation above the turbine.

- Plant factor is the ratio of the average load on the plant for the period of time considered to the aggregate rating of all the generating equipment installed in the plant.
- A pumped storage hydroelectric plant is one in which power is produced during peak load periods by using water previously pumped from a lower reservoir to an upper reservoir during off-peak periods. There are two major categories of pumped storage projects:
 - (1) Pure developments produce power only from water that has previously been pumped to an upper reservoir;
 - (2) Combined developments utilize both pumped water and natural streamflow for the production of power.
- A reregulating reservoir is a reservoir used for the purpose of regulating the outflow of water discharged from an upstream power reservoir.
- A tubular-turbine unit consists of an axial flow turbine connected to a generator which is located outside the water passageway where it is fully accessible.
- A utility plant is any privately, publicly, or cooperatively owned plant that generates electricity for sale.

APPENDIX B

TECHNICAL DATA

- State-of-the-Art: Small Hydro Technology
- Explanation of Turbine Technology
- List of Turbine Manufacturers

STATE-OF-THE-ART

A basic question concerning the technology of low-head hydro is the differentiation between small and large low-head hydroelectric power projects. Modern technology is available in the United States as well as abroad to provide satisfactory low-head turbines of any capacity needed. The demand for such equipment has been very limited in the United States due to past economic conditions. With the changed market conditions, manufacturers are able to immediately meet the demand. There does not appear to be a substantial need for R&D funds for the purpose of improving low-head turbine designs.

While current technology provides an adequate immediate technological base for low-head hydro development, innovative technology should be encouraged and researched. It appears that the problem basically is economic versus uneconomic low-head hydro. A key factor in improving economy can be in standardizations. It is estimated that the overall cost of low-head hydro site development both with and without existing dams could be reduced by 10% to 20% if equipment and civil construction were standardized. The saving would come from pre-developed dimensions simplifying such construction items and removing detailing. Among structures that should be studied for standardization are the 1) foundation walls; 2) concrete embedment of equipment; 3) intake shape, gates, hoist, motor, and controls; 4) draft tube shape and closure bulkhead; and

5) spillway crest, gates, piers, holsts, and control. Other items undoubtedly can be added to the list during initial planning of the standardization studies.

The basis for standardization begins with the hydraulic turbine. Funding to expedite turbine standardization can provide a potentially increasing benefit in the associated equipment and civil structures.

The immediate need and indicated demand are for units suitable for heads up to approximately 18M (58 feet). Such units must be in reasonable physical size and design head increments to provide a suitable range of capacities.

Having standardized the turbine, the generator and auxiliaries, electrical systems and accompanying containment structures can then also be in modular increments. The standardization of the civil structures would apply above the basic foundation sub-structure. The foregoing in effect will provide package plants, both small scale and larger scale.

Automatic control and monitoring systems are available and must be utilized. The complexity and cost of the controls can be reduced if the plant is part of a large system. In smaller systems more elaborate measures are necessary for voltage and frequency control. As with turbine standardization, funding could serve to accelerate standardization of other plant components.

EXPLANATION OF TURBINE TECHNOLOGY

Francis Type Turbine

The Francis type turbine proved to be the most enduring of the early designs, remaining today sensibly as it was first developed. In this turbine, the flow pattern approaches radially inward, normal to the shaft axis of rotation; it passes through the guide vanes, reaches the runner vanes, is then turned downward through the vanes by the runner hub. If the discharge edge of the runner vanes is curved back in a "spoon" type fashion, the flow tends to exit with both axial and radial components, and this is called mixed-flow. Otherwise the discharge is predominantly axial.

The first turbine of this type with the inlet guide vanes outside the runner, appears to have been patented by Samuel Dowd in 1838 (U.S.) (see figure 25).

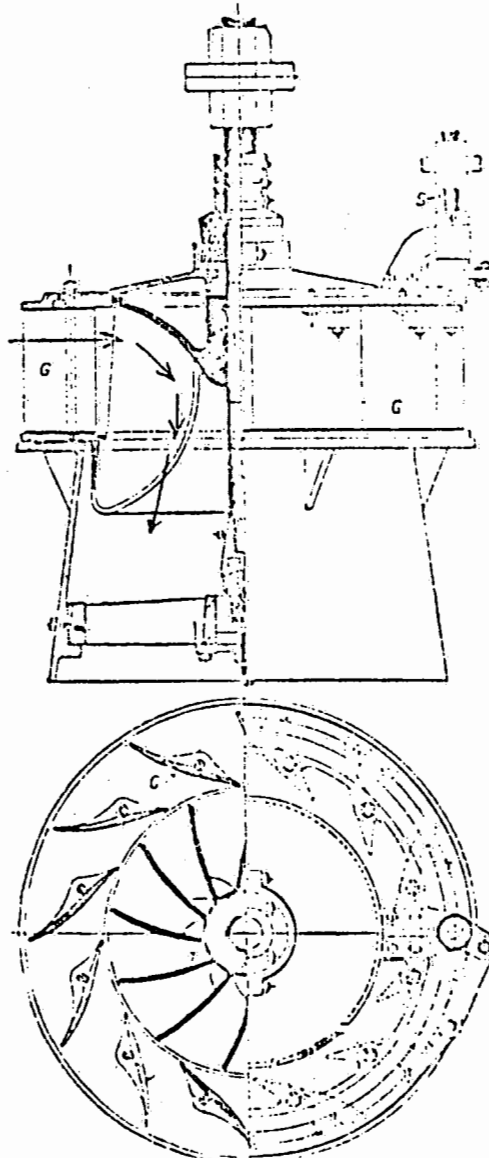


FIG. 25—"New" Francis Type Turbine

Impulse Turbine

In the impulse turbine, the flow is not delivered to the runner with pressure, but rather only with velocity. This is provided for by delivering the flow under pressure to a discharge nozzle(s), and then allowing the flow to discharge into the open air and through a gap before it strikes the runner vanes. Thus kinetic, rather than pressure, energy is the mode of delivery to the runner in the impulse wheel.

Since the reaction turbine works under pressure, the buckets should always remain full of water - to this end, inflow should occur continuously around the entire periphery of the wheel. If it does not, velocity and pressure gradients will not be uniform, and decrease in efficiency results. In the impulse wheel, however, inflow may take place continuously and uniformly around the entire circumference of the wheel or, more commonly, only at part of the periphery, without loss of efficiency.

Turbine design and usage has now reached the point where impulse types are only optimal, in the large sizes, at heads say over 800 ft. In the small sizes, this head range for optimal benefit may decrease appreciably. Historically, however, no such delineation was naturally obvious until perhaps the end of the 19th century. This evolution may be of interest.

Impulse wheel design evolved in two directions simultaneously. In the U.S. the tangetial type with split buckets was developed; the high heads utilized for hydraulic mining of gold in the California gold rush provided a natural environment for this development. This type has become known as the Pelton wheel, after Lester Pelton's commercialization of the design.

In Europe, the Haenel, Zuppinger and Schwankrug designs were developed, as well as the better known and widely utilized Girard turbine. These turbines were either axial or radial flow type, rather than tangetial, and they were (except for the Schwankrug) adaptable to either partial or full flow admission.

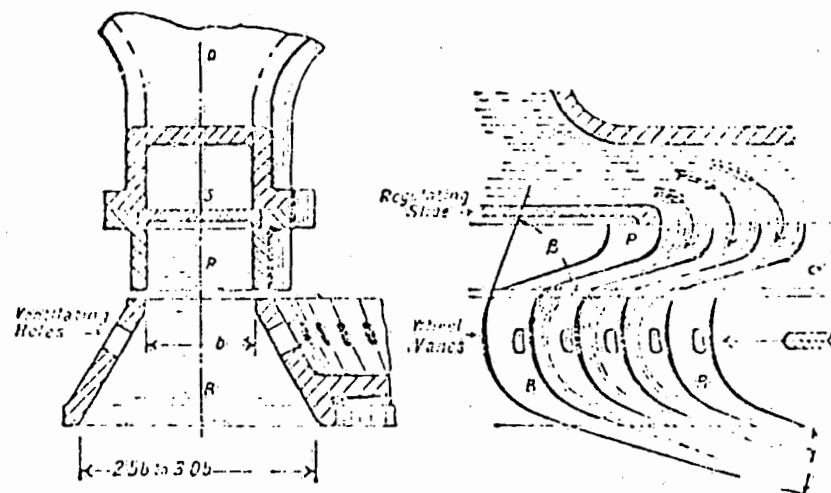


FIG. 203. Axial Flow Girard Turbine.

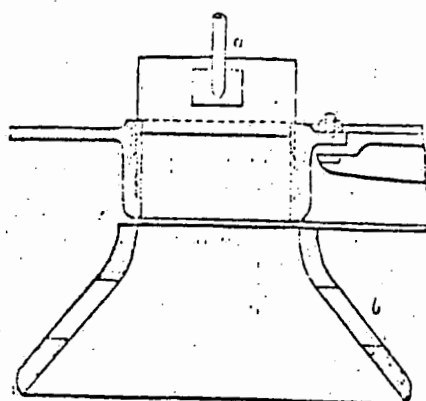


FIG. 199.

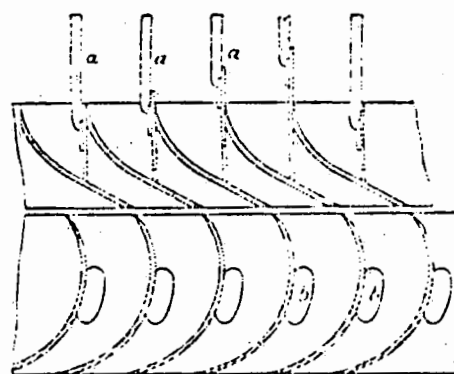
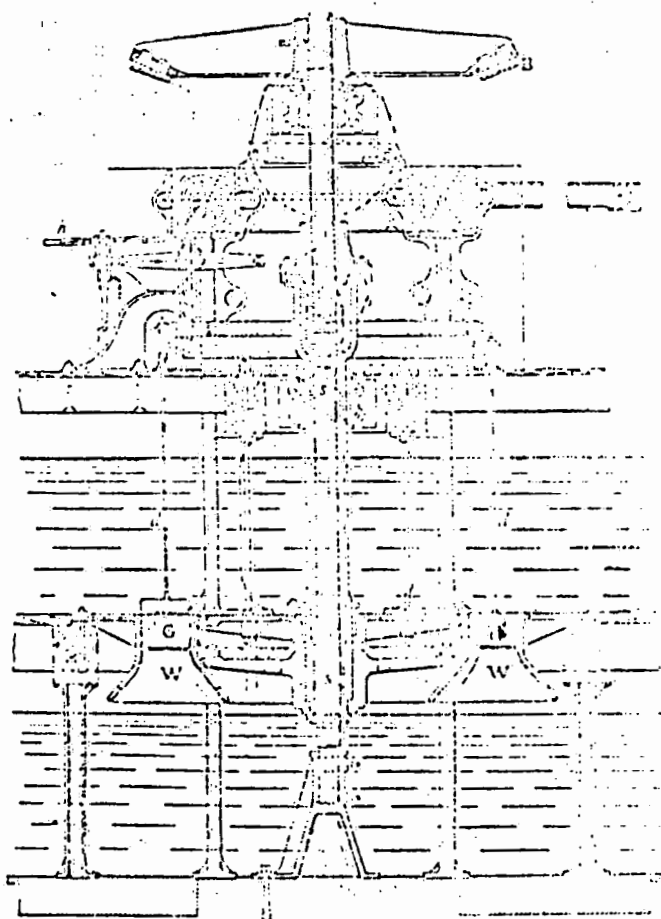
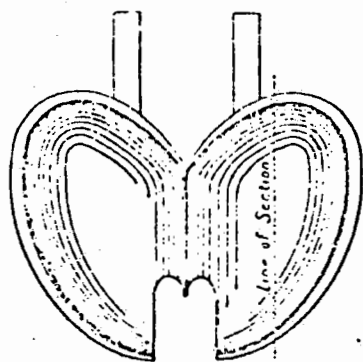


FIG. 198.

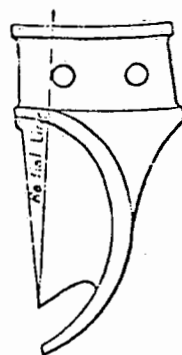




a.



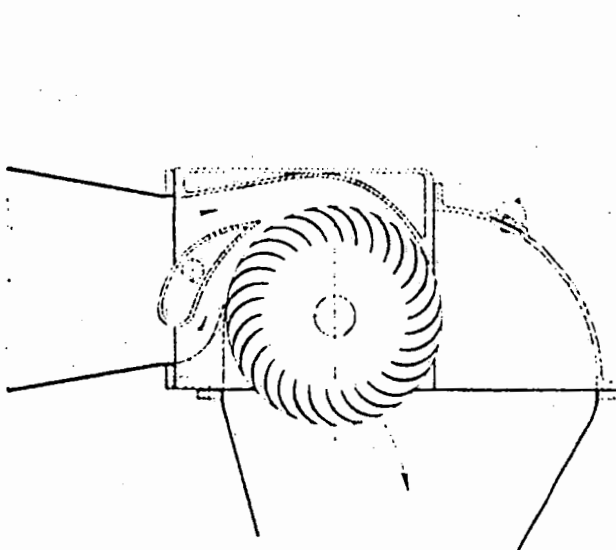
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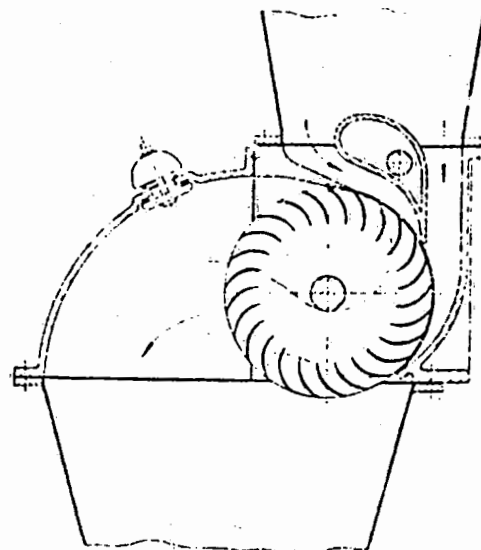
Double Impulse Water Turbine

In 1903 the eminent Australian engineer Michell secured a British patent for his radial flow, double impulse water turbine. Michell was a mathematically sophisticated engineer (who also invented the Michell-Kingsbury thrust bearing and the swashplate engine) and presented the turbine in analytic detail. Little is known, apparently, about the turbine until 1917, when Prof. Donat Banki (Budapest) secured German patents on an identical design, accompanying this with a rigorous treatment of the theoretical background. Banki, who died in 1923, sold the design rights to the Ganz-Mavag turbine company. This concern gradually improved the design, particularly in terms of through-flow capacity; by 1946, when they discontinued production, several thousand had been produced.

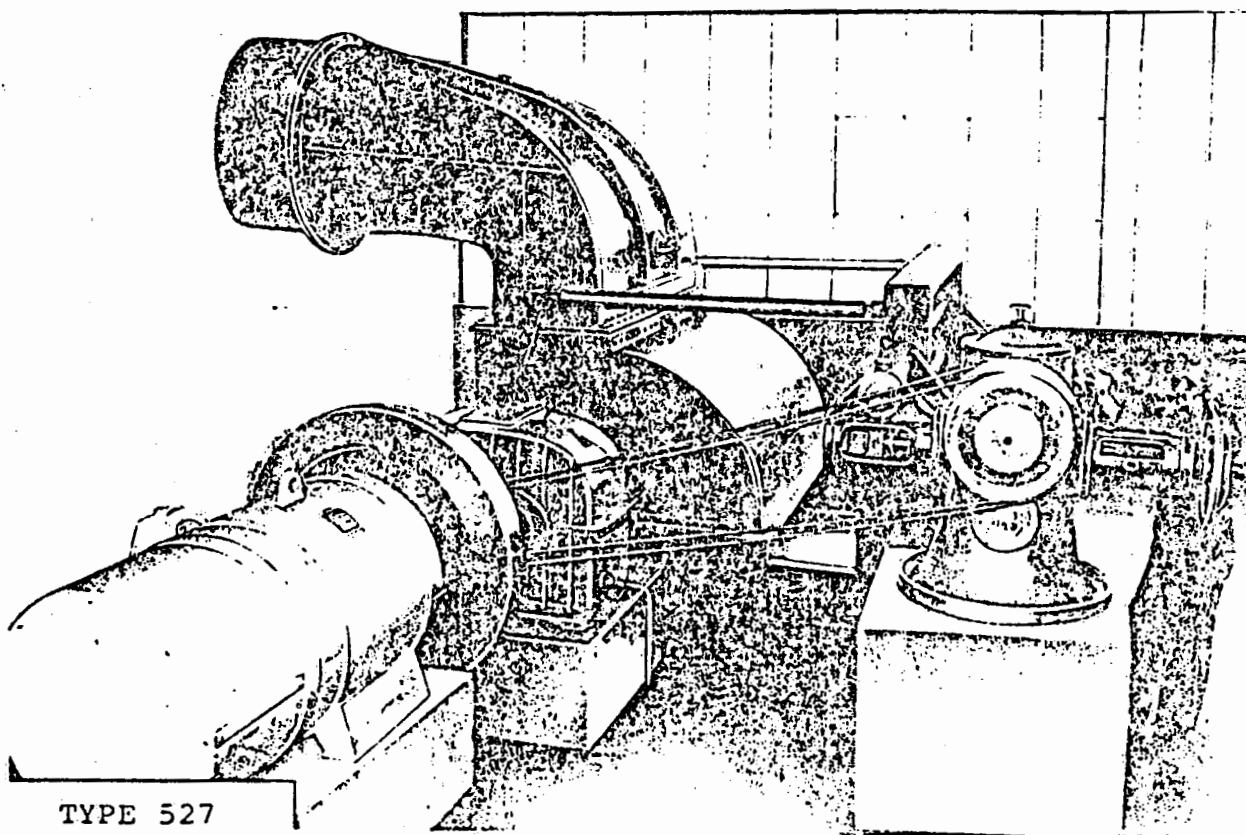
The Ossberger has been virtually unchanged for the last twenty years apart from an escalation in the size of units to exploit large volume, low head sites. The turbine now looks like this:



Flow pattern in OSSBERGER cross-flow turbine; horizontal admission.

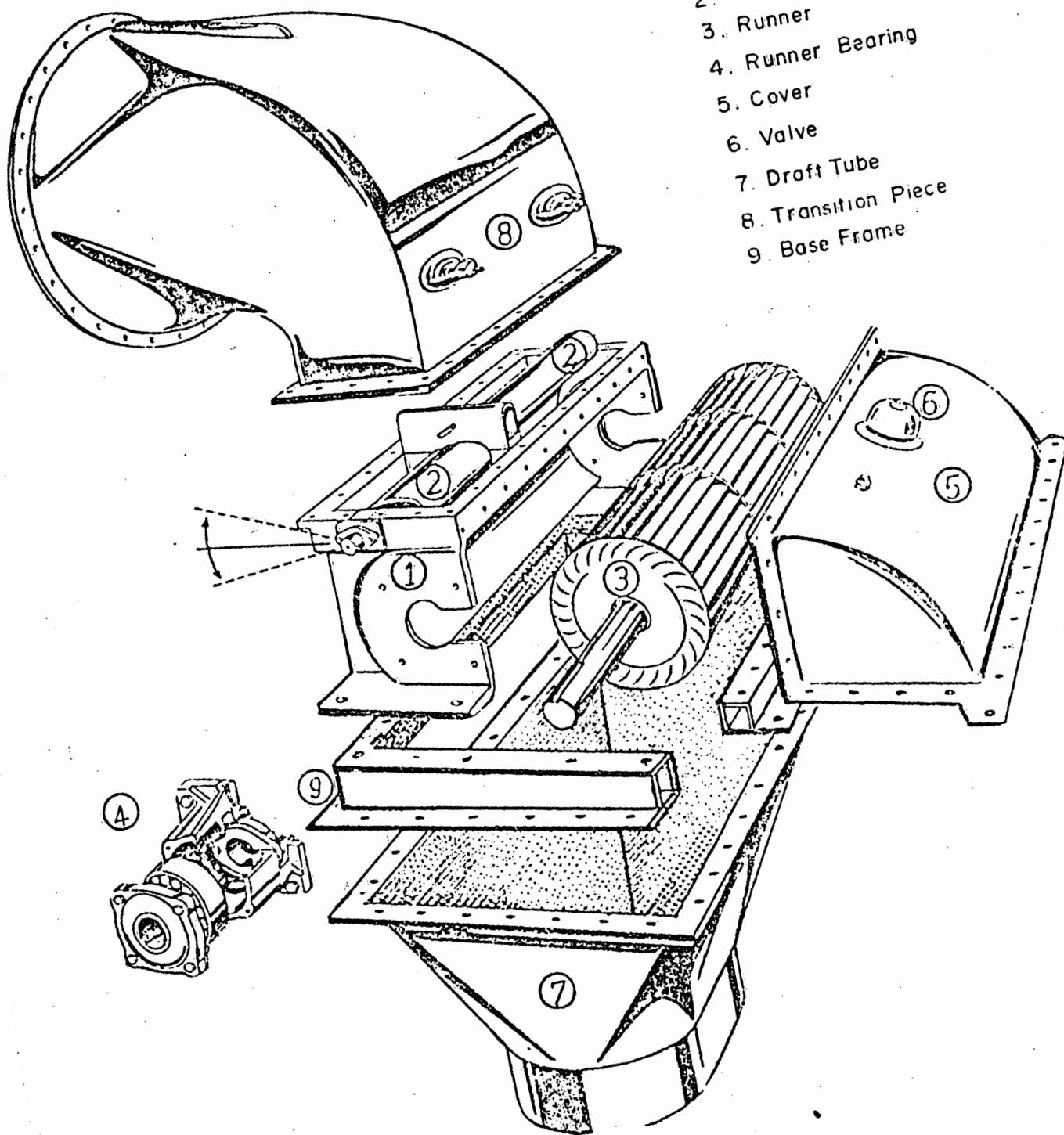


Flow pattern in OSSBERGER cross-flow turbine; vertical admission.



TYPE 527

1. Housing
2. Guide Vanes
3. Runner
4. Runner Bearing
5. Cover
6. Valve
7. Draft Tube
8. Transition Piece
9. Base Frame



Cross Flow Turbine

The cross flow turbine is a rather unique type of machine. It dates back to the turn of the century, thousands have been produced, and it has been installed all over the world. Yet there is still no definitive corpus of information on the design. This is perhaps due to the efforts of Ossberger Turbinen-Fabrik to keep their design advances very closely held.

It can not be denied, moreover, that the turbine is perfectly suitable for low head application. At the moment such application appears to be quite expensive relative to other types of turbines. However, if more were known about the stresses, and economics of construction were possible, along with more competition in its manufacture, it is possible that this turbine may be quite competitive. Certainly the economics of operation and maintenance weigh heavily in its favor.

The cross flow turbine also bears further consideration in view of the fact that so many old sites were installed as horizontal shaft machines, and it is not unthinkable that this type of unit would retrofit with the minimum of reconstruction.

A great deal more needs to be known about the economics of this design, and doubtless representative installations will soon be made that can compare the cross flow with more standard types of equipment.

Inward Francis Runners

In the autumn of 1903, Victor Kaplan, a young Austrian mechanical engineer, assumed the position of designer at the German Technical University at Brno. He presently began work on improving the speed and capacity of inward Francis runners. His approach was both analytic and experimental, since he was afforded the opportunity to establish a research laboratory for turbine testing.

The quest for higher speeds led to the development of a Francis runner with only four blades, the outer ends of which resembled an axial runner. He therefore next designed an axial flow runner with a small number of blades without, however, discarding the runner band; this wheel achieved an unprecedented specific speed of 202. This speed was twice as high as any previously known, and it was done without sensible sacrifice of efficiency. The discharge capacity was appreciably higher as well.

Further studies then led to the conclusion that for part-discharge, this fixed propeller arrangement suffered drastic efficiency losses. Kaplan next made his famous observation that the required flatter blade angle could simply be achieved in the same machine by making the propeller of variable pitch. It was further discovered that it was not necessary to also guide the flow closely between stationary guide vanes, movable guide vanes, and runner. There thus existed a bladeless space between the guide vane ends and the runner; the next step was to do away with the runner band, lowering resistance even further.

Evidently Kaplan then consolidated his achievements with patent applications in the following order:

1. Changeover from the Francis to the axial runner, 11 December 1912, in Austria.
2. Adjustable runner blades, 7 August 1913.

3. Adoption of a bladeless space between radial distributor and axial runner, 16 September 1913.
4. Making the blade length shorter than the blade spacing, i.e. a runner avoiding the cell-shaped space, 6 October 1913.
5. Elbow draft tube with a sharply bent outer contour but a gently rounded inner contour.

Many turbine manufacturers were deeply impressed with Kaplan's achievement. At the same time, however, Kaplan remained very secretive about his design, particularly the fact and the method of adjustable blading. He also was asking substantial amounts for his design, and the result was that most manufacturers considered the risk too high to accept. Then in 1914 the war broke out, limiting civilian manufacturing activity. And when the patents were finally disclosed, Kaplan was faced with many suits based on counterclaims and priority.

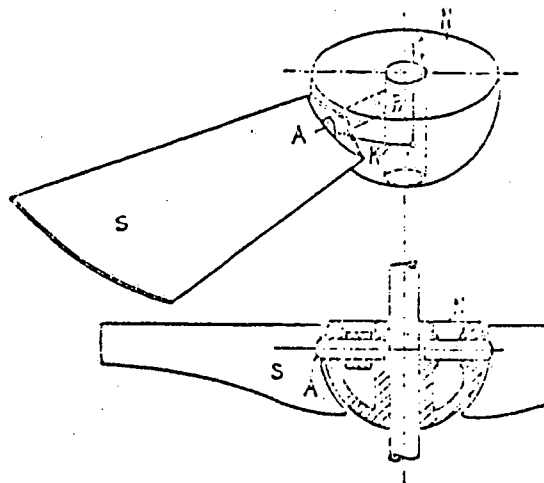
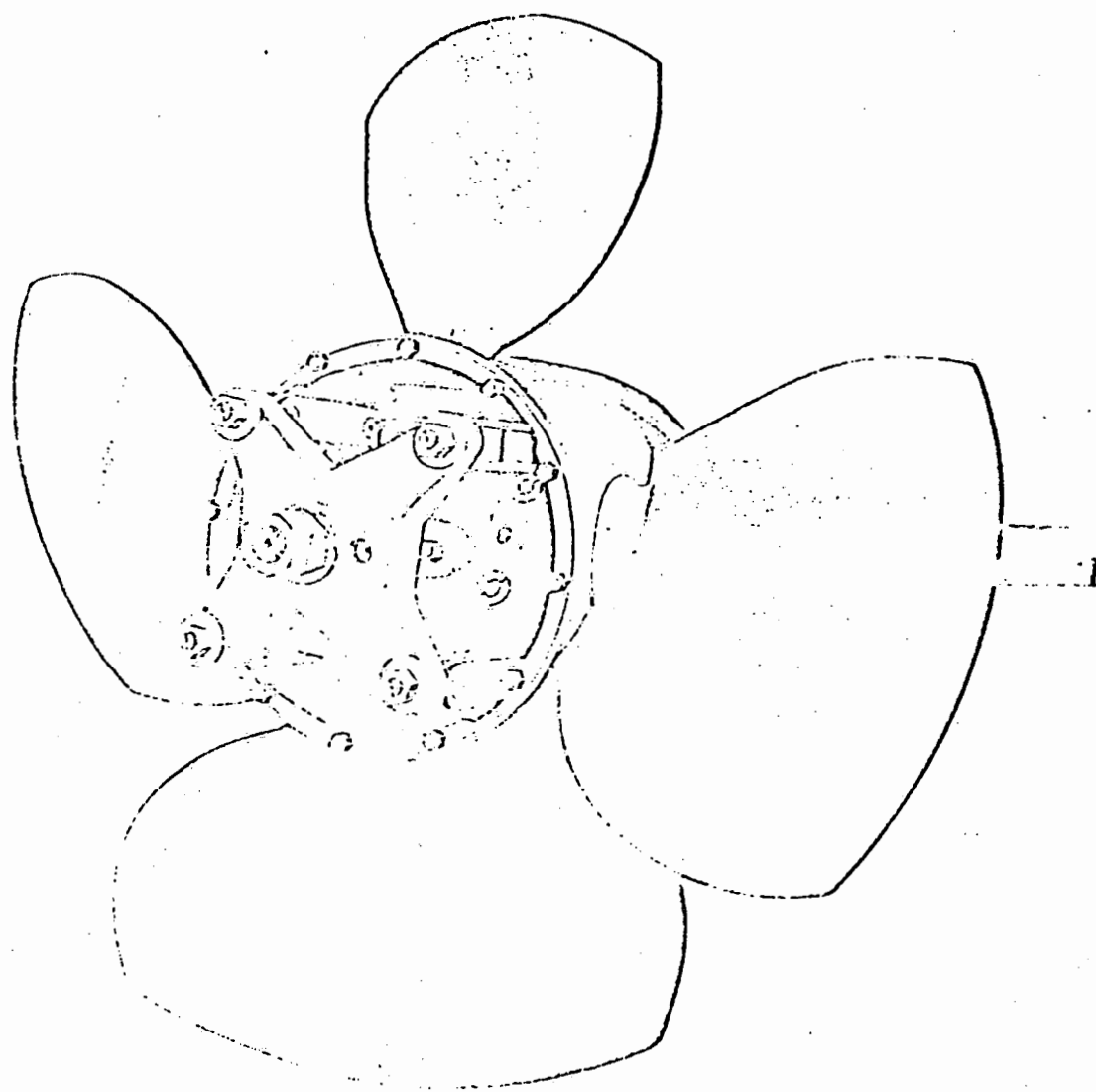
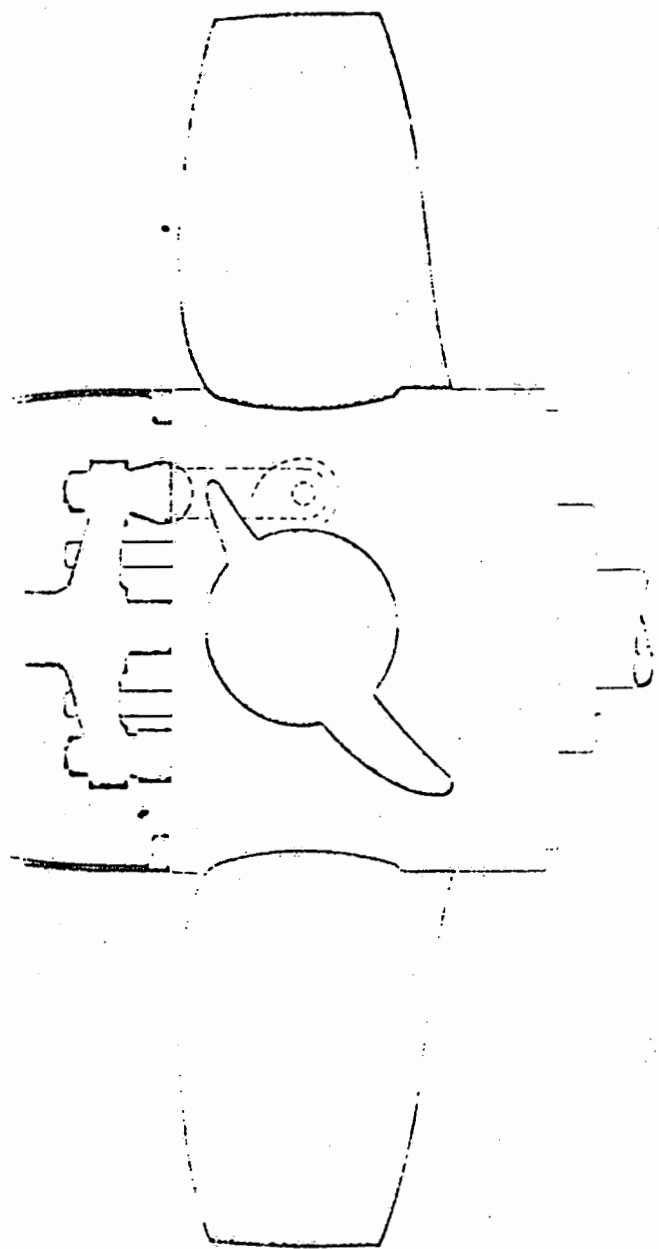
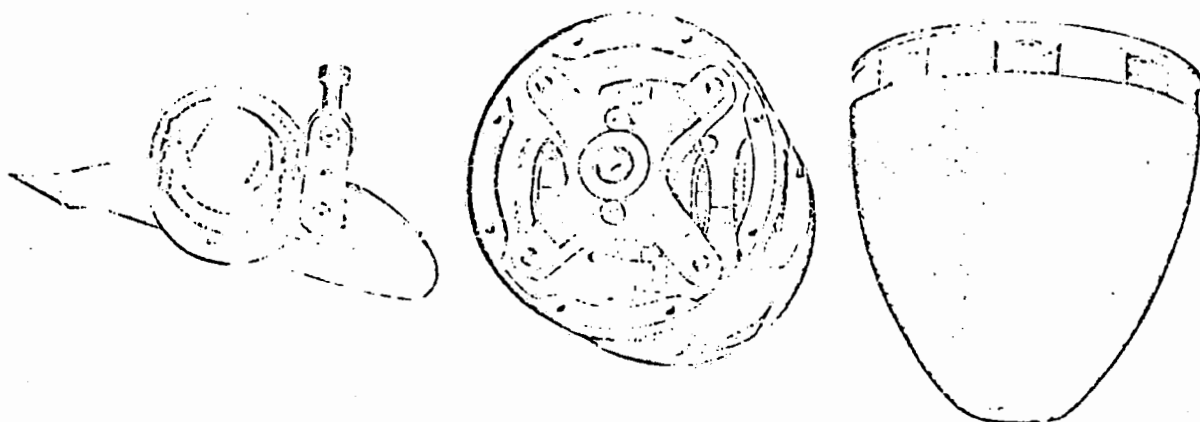
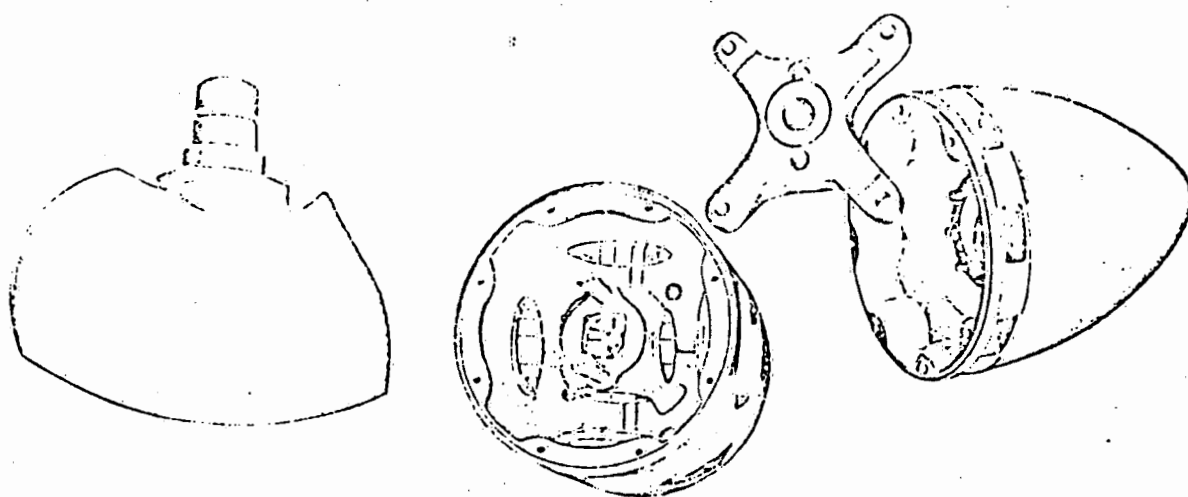
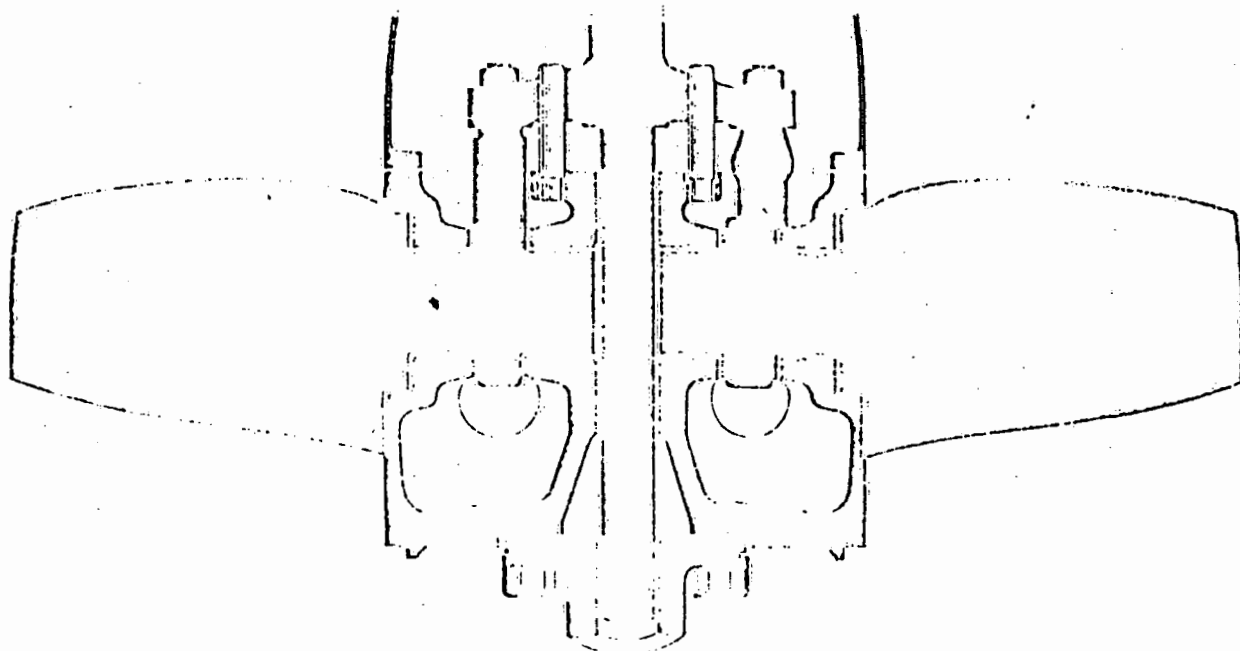
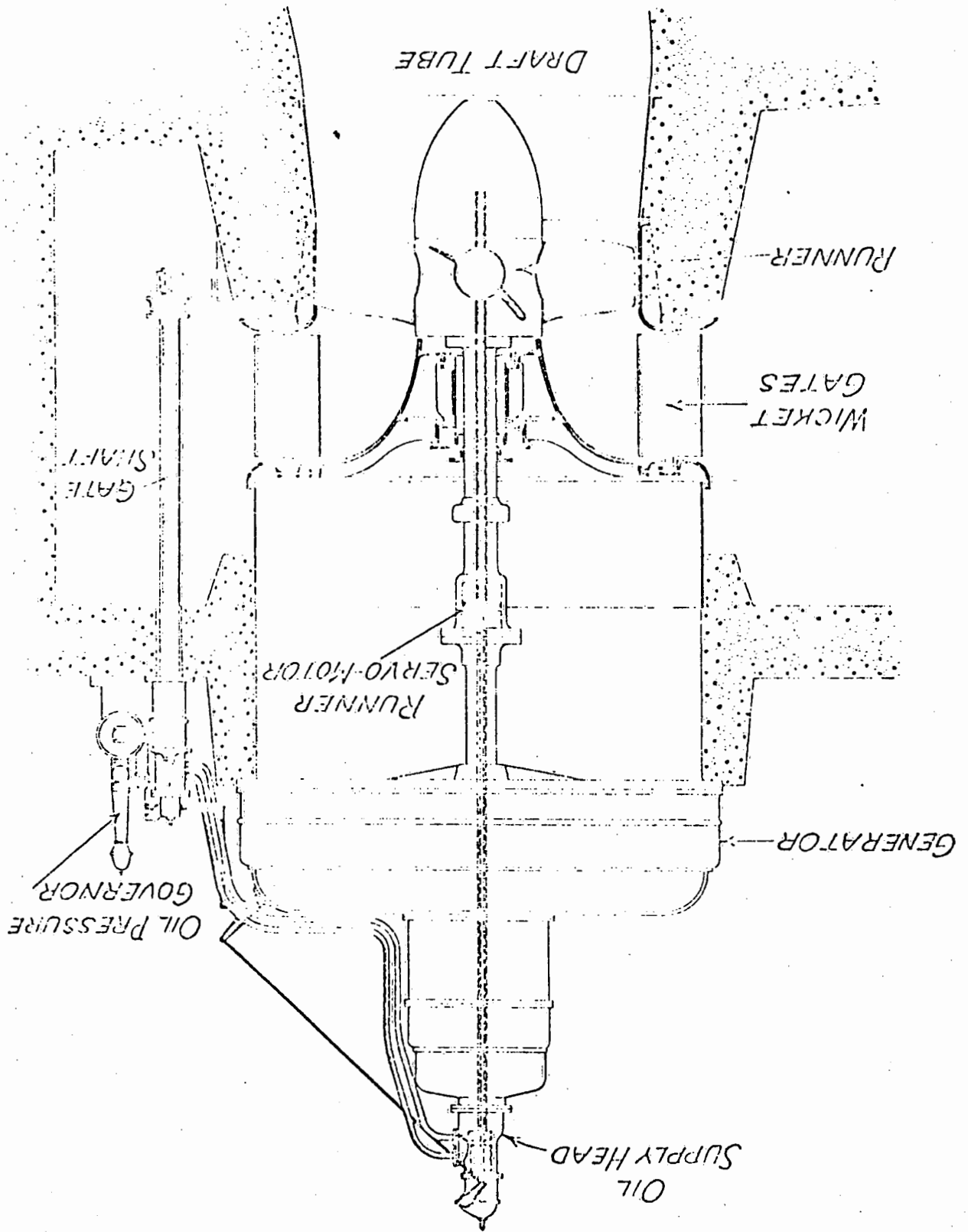


FIG. 707.—Original drawing accompanying Professor Kaplan's patent.



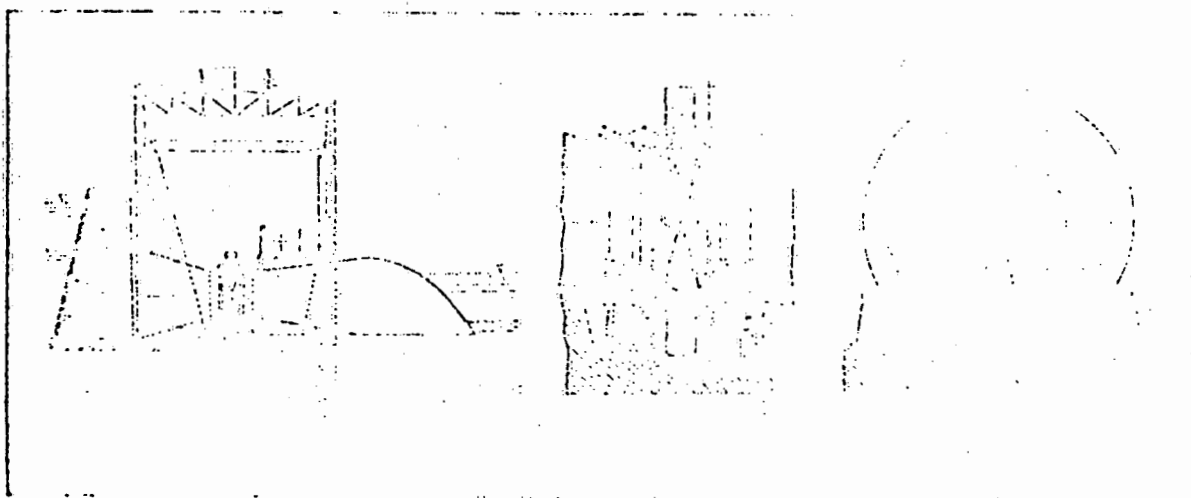


Open Flume Setting of SMITH-KAPLAN Turbine



STRAIGHT FLOW HORIZONTAL TURBINES

Not long after Kaplan's invention, an American engineer Leroy F. Harza patented (1919) a horizontal adjustable blade propeller unit, with the unusual feature of the generator rotor constructed integrally on the periphery of the turbine rotor. The original patent drawing is given below:



This design incorporated many hydraulic and structural advantages. Compared to a vertical unit, the overall length of the water passageways was reduced; the inlet and outlet quarter turns were done away with; the minimum center distance at which multiple units could be installed was reduced. There also results a large natural inertia which helps to ensure stable running, while at the same time doing away with a drive shaft.

These advantages are, however, balanced by problems connected with bearings; seals to keep the submerged generator

watertight; and ability to incorporate adjustable runner blading into the design.

During the years 1937-1951, Escher Wyss installed some 73 rim generator type units. The installations took place in 14 power stations, over a head range of only 8.0 to 9.2 m. The runner diameters were small, and varied only slightly in size: 1950-2100 mm. Outputs were from 1,000 to 1,900 KW.

An illustration of one of these units is given below:

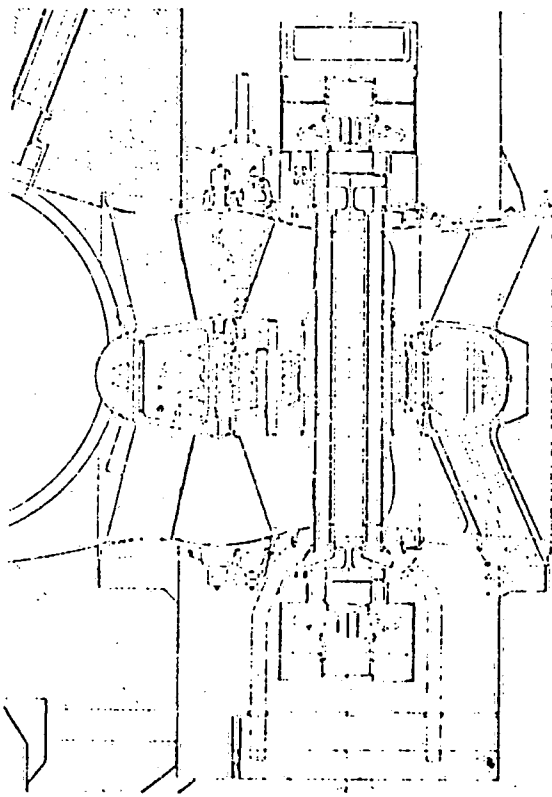


FIG. 6. Rim generator unit.

Fig. 6. Flow design of the rim generator. External dia of turbine runner designed as magnet ring of generator. Easy to change the unit as regards flow of guide blades. Runner made in one piece of cast steel, diameter 195 mm. Blades cast on body of the external ring, magnet ring mounted on. Regulation simply by adjusting the guide vanes.

2.3.3.2 Ortatschalskoj Power Station (Russia)

In 1953 three Straight Flow turbines were installed on the Kera river with the following characteristics (6):

Output	6.3 MW per unit
Head	10.5 m
Speed	125 rpm
Runner diameter	3300 mm

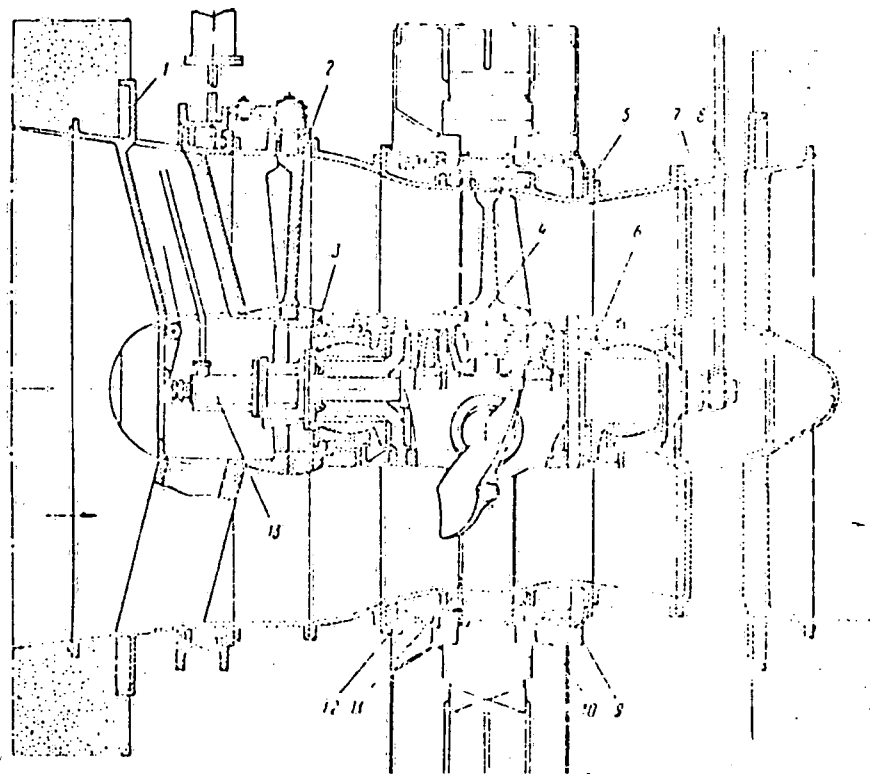


Fig. 10 Section through the Ortatschalskoj
Straight Flow turbines (Russia)

The Tube Type Turbine

Harza's concept of the horizontal, straight-through rim generator unit was patented in 1919. Then in 1923, the French firm of Neyrpic put forth a proposal for the Aswan Dam machines in which the flow, while not quite straight-through, only deviated by about 45°. The turbine of course was a propeller type, either with or without double regulation, and the generator would have been placed above the water passageways in a separate enclosure, via a rather lengthy shaft. These designs were not accepted by the Egyptians, so the units were not produced. The arrangement, however, has been accepted as a standard type, and is now known as the tube type turbine.

Apparently Cayere of Neyrpic did not apply for patents, since in 1930 a German, Kuhne was granted a patent for the so-called tube design. The design seems next to have been exploited by Allis-Chalmers. In 1938 they installed 3 units of 3,450 HP each under 23' head in Traico, Brazil. Since that time, A-C has made a number of tube installations: they are given below:

YEAR	OWNER	LOCATION	# UNITS	HEAD	RPM	UNIT HP
1938	Sao Paolo Tramway	Traico, Brazil	3	23'	150	3450
1951	Wisc./Mich. Power Co.	Lower Paint	1	20'	514	155
1962	Consolidated Papers,	Lower Stevens Pt.	1	22'	150	2800
1963	Imperial Irrig. Dist.	Turnip Check, CAL	1	16.5	218	570
1964	Orillia Lt. & Power	Swift Rapids, ONT	2	47	277	3500
1965	City of Norwich, Conn.	-same-	1	15.5	129	1999
1965	US Corp of Eng.	Ozark Lock and Dam	5	32.3	60	33800
1965	Quebec Hydro	Caudiere II, Canada	1	38	100	14000
1967	US Corp of Eng.	Webbers Falls, Okla.	3	26.5	60	30900
1972	Northern States Power	Conell, WI.	3	36	100	13900
1974	Great Northern Paper	Dolby, ME.	2	48	212	5680

TUBE TURBINES

TO PROVIDE POWER AT THESE INDUSTRIAL AND UTILITY HYDRO INSTALLATIONS...

STEVENS POINT

Consolidated Papers, Inc., Wisconsin

2800 hp — 22 ft. hd.

Modern low-head TUBE turbine utilizes existing flume and boosts capacity. In June, 1962, Consolidated Papers, Inc., Wisconsin Rapids, Wisconsin, awarded the York Plant of Allis-Chalmers a contract to build the first modern low-head, horizontal, adjustable-blade TUBE turbine for their Wisconsin River Division. This contract was the culmination of several years of effort on the part of Allis-Chalmers personnel to prepare a complete study and proposal defining the new low-head TUBE turbine and to adapt it to the most suitable location.

Figures 5 and 6 illustrate the arrangement of the TUBE turbine at the end of the pulp mill.

Nine horizontal, double-runner units with draft chests are in operation at this plant. Four similar, but smaller, units had been discontinued many years ago. Most of the existing units employ synchronous motors directly connected either between the turbines and wood grinders, or to the end of the grinder shaft. These motors can provide addi-

tional power to the hydraulic turbines, drive the pulp grinders, or act as generators. The existing flumes at this plant had unit capacities ranging from 530 to 850 horsepower, under a head of 21 ft. Discharges ranged from 250 to 470 cfs. The TUBE turbine unit is capable of developing 2800 hp under 22 ft. head — more than three times the capacity of similar adjacent flumes.

Based on available river flow-duration data, the Wisconsin River Division Plant was developed for average flows available at least 42% of the time. If there should be a reduction in ground wood requirements, water would be wasted. The addition of the 1800 KW TUBE turbine increases water use capability and provides the needed flexibility in plant operation.

Uses economical inlet valve. A specially designed patented inlet valve (shown in Fig. 7) is arranged to provide a streamlined approach to the turbine. It also provides positive closure, even under loss of operating pressure. The economical valve opens and closes under full unbalanced head and flow conditions via hydraulic operating pistons centrally located upstream in the intake pier.

A high-pressure oil system provides a reliable, economical, and compact power source. The same system can be used for operating both inlet valve and runner blades.

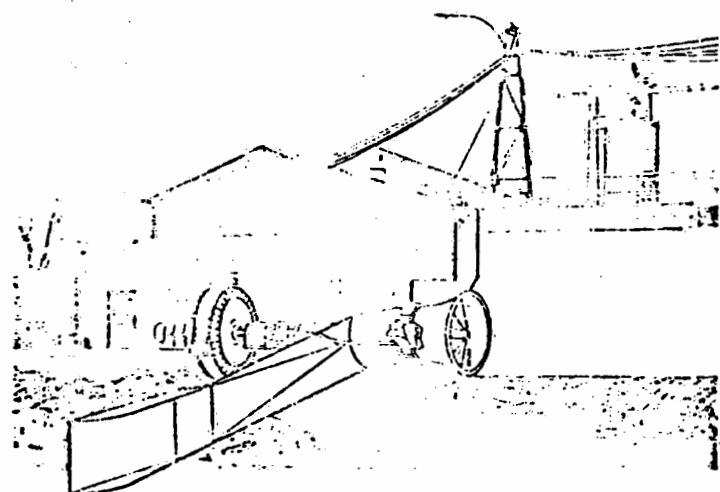


Fig. 5 — Cross section of powerhouse.

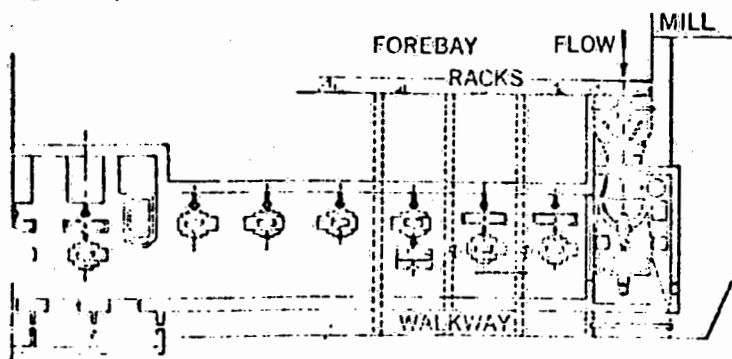


Fig. 6 — Plain view of powerhouse showing TUBE turbine addition

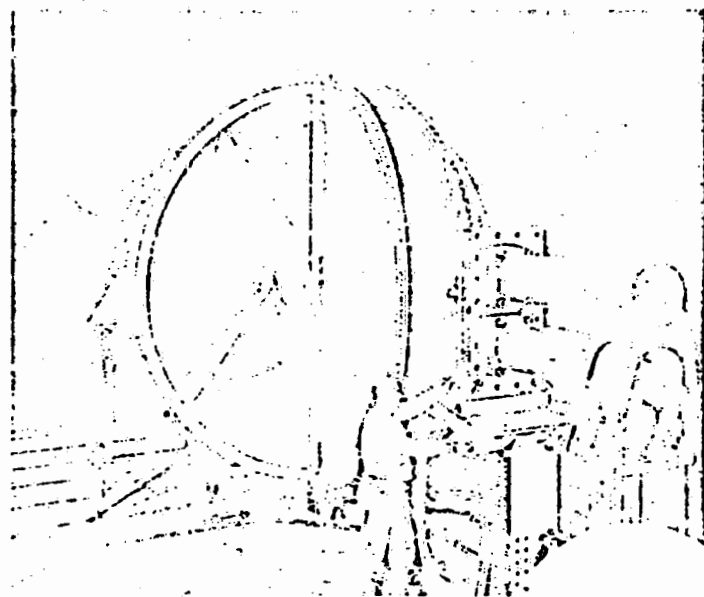


Fig. 7 — Inlet valve, open position.

ALLIS-CHALMERS

OZARK LOCK AND DAM

Corps of Engineers, U. S. Army, Arkansas
33,800 hp — 32.3 ft. hd.

World's largest TUBE turbines. In 1965, Allis-Chalmers was awarded a TUBE turbine contract for the Ozark Lock and Dam Project (Fig. 8). This contract included five large TUBE turbines with gear type speed increasers. Each unit, rated 20 MW, has radial wicket gates coordinated with adjustable runner blades. The tremendous physical size of these units (over 26 ft. runner dia.) classifies them with the largest Kaplan type turbines ever built and makes them the largest TUBE turbines in the world.

Feasibility studies were conducted by both the Corps of Engineers and independent consulting firms. The Corps of Engineers has indicated that a 5 million dollar savings would be realized using TUBE turbines as compared to conventional vertical Kaplan units. The savings were largely attributable to decreased powerhouse excavation and shorter overall powerhouse structure — inherent characteristics of the TUBE turbine design.

The Ozark TUBE turbines are arranged as shown in Fig. 9, with the shaft inclined upward in the downstream direction. The inclined arrangement minimizes draft tube excavation and allows the vertical component of the weight of rotating parts to counteract the hydraulic thrust on the runner.

The speed increaser will step up the slow turbine speed (60 rpm) to a more economical generator speed (514 rpm). A two-path, double-reduction speed increaser will be used with the input and output shafts off-set vertically.

All five units are scheduled for operation in 1970.

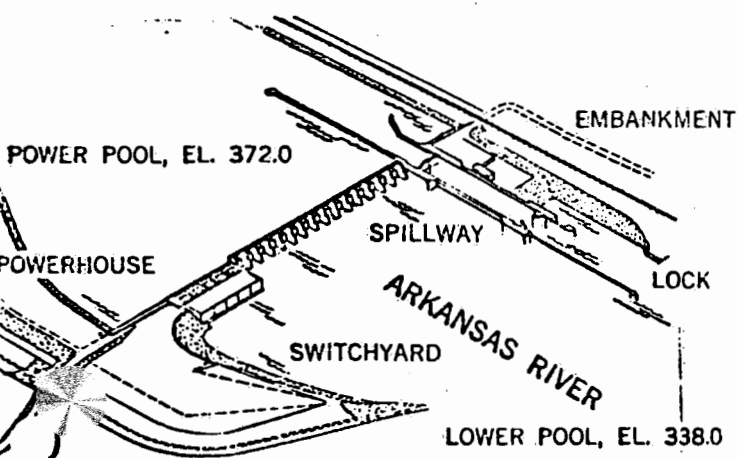


Fig. 8 — Overall project view.

CHAUDIERE #2 PLANT

Hydro Quebec, Canada
14,000 hp — 38 ft. hd.

First adjustable blade — adjustable gate TUBE unit. Hydro Quebec's order for an Allis-Chalmers TUBE turbine is the first TUBE turbine to utilize both adjustable blades and wicket gates (Fig. 10). This TUBE unit will be manufactured by Canadian Allis-Chalmers and installed in an existing flume at the Chaudiere #2 plant located on the Ottawa River.

By using a TUBE turbine instead of a conventional vertical unit, an estimated \$400,000 project savings will be effected in civil construction costs.

Also, the 14,000 hp TUBE turbine increases unit output 86%, compared to the 7500 hp output of the adjacent, older units. All units are rated at 38 ft. head.

Upstream wicket gates at the Chaudiere Project eliminate the need for an inlet valve and improve the overall performance and operating flexibility of the TUBE unit.

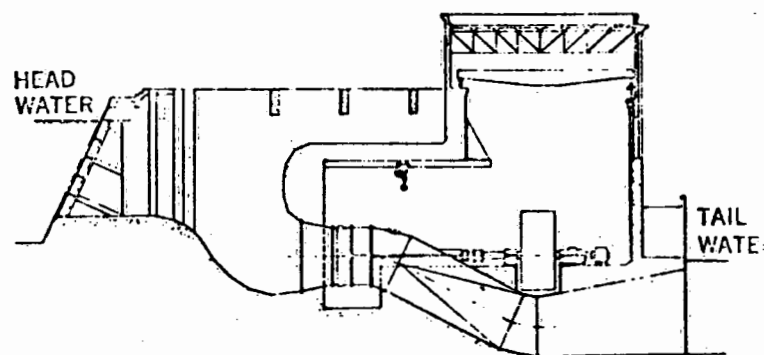


Fig. 10 — Powerhouse cross-section view with new TUBE turbine.

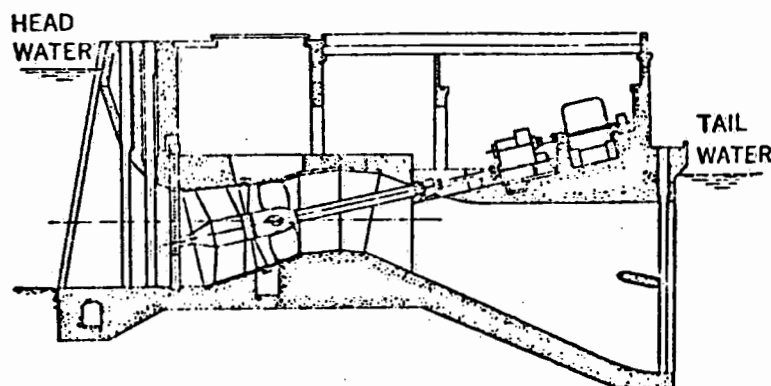


Fig. 9 — Powerhouse cross-section showing TUBE turbine arrangement.

OTHER TUBE TURBINE INSTALLATIONS INCLUDE..

LOWER PAINT DEVELOPMENT

Wisconsin-Michigan Power Company

155 hp — 20 ft. hd.

First TUBE turbine in the United States. The first Allis-Chalmers TUBE type turbine in the United States was installed in 1952 at the Lower Paint Dam (Fig. 11).

Here, most of the river's flow is diverted to another site. The TUBE turbine's discharge provides the maximum flow required to maintain fish life and protect scenic beauty.

The turbine consists of a 30" horizontal fixed-blade propeller with an elbow draft tube discharging into a conventional tailrace. It is rated at 155 hp under 20 ft. net head and operates at 533 rpm. The intake bell contains stationary guide vanes, and a sliding intake gate is provided for start-up of the turbine and tight closure of the water passageways. The turbine shaft is directly connected to a 100 kilowatt induction generator. Since the turbine has both fixed blades and fixed gates, it has only one operating point at a given head.

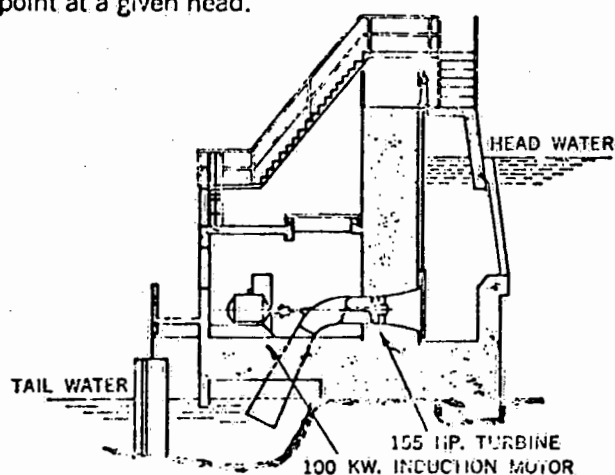


Fig. 11 — TUBE turbine unit installed.

TURNIP CHECK

Imperial Irrigation District, California

570 hp — 16.5 ft. hd.

Utilizes drop in canal elevation. In 1963, the Imperial Irrigation District installed a 570 hp TUBE turbine on its West Side Main Canal. The outdoor-type, unattended unit utilizes a 16.5 ft. drop at the Turnip Check. Studies conducted by the District indicated that such a marginal site could be made economically practical.

The unit consists of an adjustable, four-blade runner, speed increaser, generator and control equipment. (Allis-Chalmers furnished complete turbine and electrical equipment.)

Prior to entering the turbine, the water travels through a standard concrete pipe. Fixed guide vanes direct incoming water onto the turbine runner. A Tainter gate provides tight shut-off. Two adjacent Tainter gates provide additional discharge capacity.

Fig. 12 shows the general arrangement (looking upstream) of this unit within the dam structure and Fig. 13 is a close-up view of the TUBE unit with the access cover removed. Note the speed increaser and generator in the foreground.

The gear-type, parallel shaft speed increaser has made it possible to use a standard induction generator. The generator, rated 420 KW, 900 rpm, is a standard bracket-type bearing machine, designed to withstand turbine overspeed. The gear unit includes bearings to withstand the hydraulic thrust of the runner and support one end of the turbine main shaft.

The adjustable blades facilitate maximum unit performance under varying seasonal heads; control can be either manual or automatic. A float control system maintains a predetermined water level range by adjusting the runner blades, varying the flow through the turbine.



Fig. 12 — Downstream view of outdoor powerhouse.



Fig. 13 — Generator, speed increaser, TUBE turbine.

ALLIS-CHALMERS

TENTH STREET HYDRO STATION

City of Norwich, Connecticut

1999 hp — 15.5 ft. hd.

Used in conjunction with peaking plant. The City of Norwich, Conn., has placed an order for a 1999 hp TUBE turbine. This unit, directly connected to an 1800 KVA synchronous generator, will be used as a peaking unit in conjunction with an existing steam plant. Here again, Allis-Chalmers will supply the intake gate, turbine, governor, direct connected generator and switchgear. Installation, as shown in Fig. 14, will be made within the customer's concrete-lined canal. The generator and accessories pit will extend slightly above the ground level; surrounding walls will prevent the entry of flood waters. Turbine shutoff will be effected by a hydraulically operated fixed-wheel intake gate.

The unit is scheduled to go into operation in the fall of 1966.

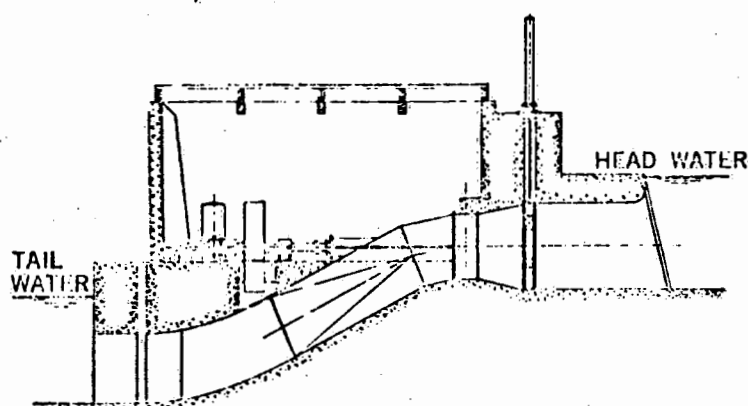


Fig. 14 — TUBE turbine with fixed-wheel intake gate.

SWIFT RAPIDS

Orillia Water, Light and Power Company

Ontario Province, Canada

Modernization increases plant output 60%. Canadian Allis-Chalmers was awarded a contract by the above company to design and build two 3500 hp adjustable-blade TUBE turbines. The Swift Rapids project, on the Trent Canal system, is located about 20 miles north of Orillia and is attached to an existing control dam on the Severn River.

Beginning in 1966, TUBE turbines will modernize the Orillia plant as shown in Figs. 15, 16 and 17, replacing two of the three existing 2,000 hp double-runner units; plant output will be increased from 4500 KVA to 7500 KVA. The flexibility of the TUBE turbine's design has made it a practical, economical replacement for the old horizontal units.

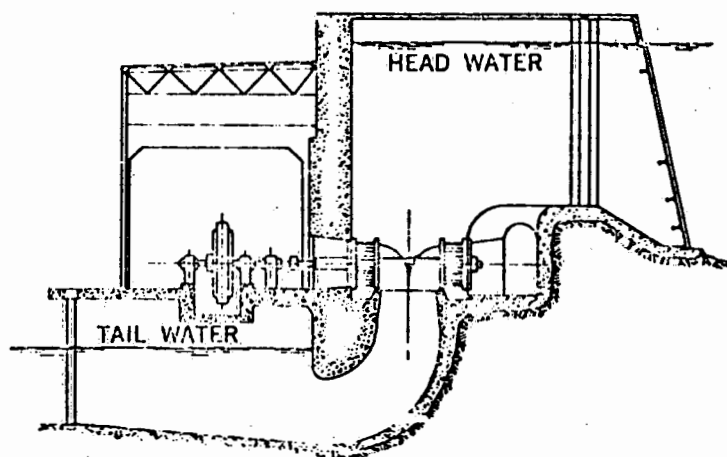


Fig. 15 — Powerhouse with double runner turbines.



Fig. 16 — Swift Rapids plant during redevelopment.

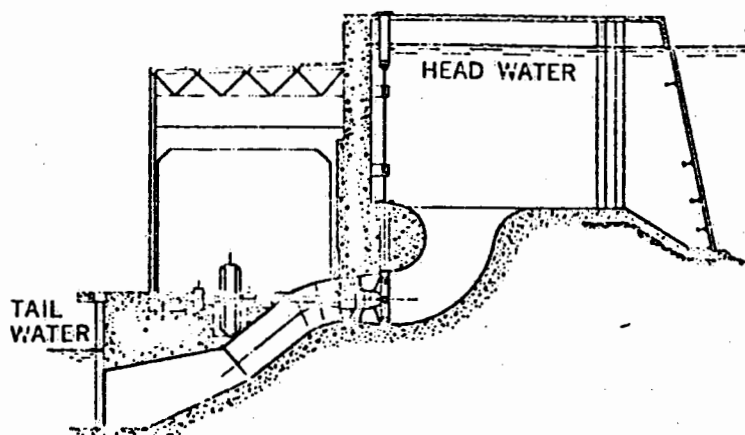


Fig. 17 — Modernization via the TUBE turbine.

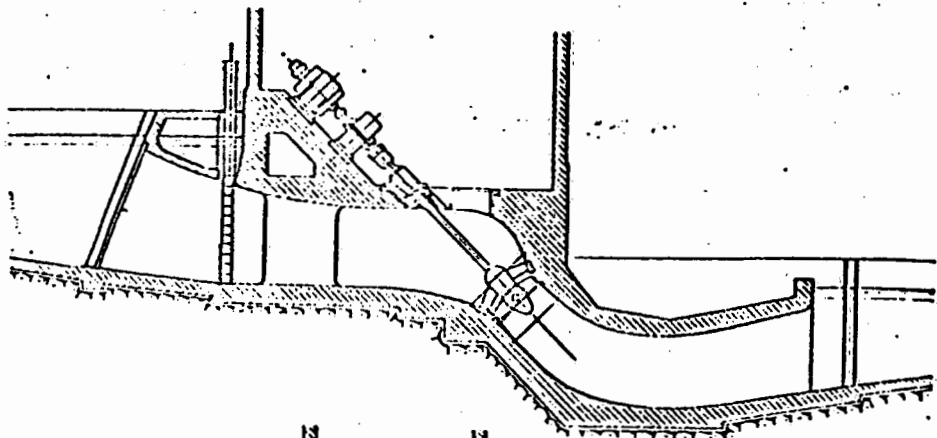
Tube Turbine

The use of the expression "tube turbine" can be somewhat misleading. Allis-Chalmers has adopted the term more or less as a trademark for their machines. In Europe, however, the term has more of a generic meaning, being applied to all turbines of horizontal axial flow, even including the rim generator type.

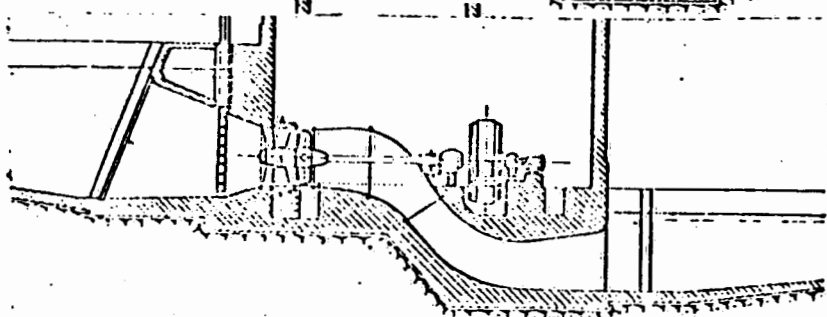
There are other configurations of the turbine/generator setting possible within this genre. Two of the main ones are the bevel gear type and the bulb type. In the former, the interconnection between turbine and generator is through right angle bevel gearing - an adoption from naval architecture and manufacture. In the latter, the generator is directly in the water passage line, but it is encapsulated in either a steel or concrete chamber.

In the diagram of a bevel gear setting given below, it can be seen that - in comparison with so-called standard tube settings, either horizontal or slightly inclined - the bevel turbine makes possible a much shorter power house construction. The generator can be of standard high speed construction, it is set outside the turbine casing, and not subject to difficult sealing or cooling problems.

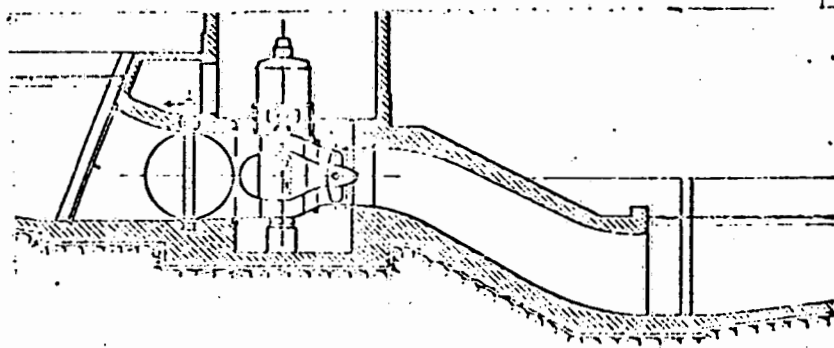
TUBE TURBINE
W/INCLINED SHAFT TO
UPSTREAM GENERATOR



TUBE TURBINE
W/HORIZONTAL SHAFT TO
DOWNSTREAM GENERATOR



TUBE TURBINE
W/BEVEL GEARING TO
VERTICAL GENERATOR



The size of the bevel gear tube turbine is limited due to limits on size in manufacturing of the gears. In recent conversations with Neyrpic, it was revealed that they have made arrangements with a German gear producer to increase this capability to the 10,000 - 12,000 HP range. This corresponds to the existing scale of production which Escher Wyss has provided:

PLANT	# UNITS	RUNNER DIA. mm	HEAD m	DISCHARGEcms	HP	RPM
Ravensburg	1	1000	4.20	4.00	193	300/1000
Arlen	2	1200	4.60	7.40	392	265/750
Untereggingen	1	1200	3.50	6.80	270	248/750
Rio Tunuyan	3	1450	6.70	9.70	780	270/750
Herrfors	1	1800	3.50	14.50	582	165/600
Weilheim	1	1800	4.35	15.60	733	186/600

In the size range given above, the complete unit can be supplied as an assembled whole, and dropped in place with overhead crane. This is depicted in the Neyrpic drawing below.

Also shown is an Escher Wyss design where a roof hatchway permits emplacement of the complete turbine, but the generator is set horizontally rather than vertically - thus necessitating separate emplacement.

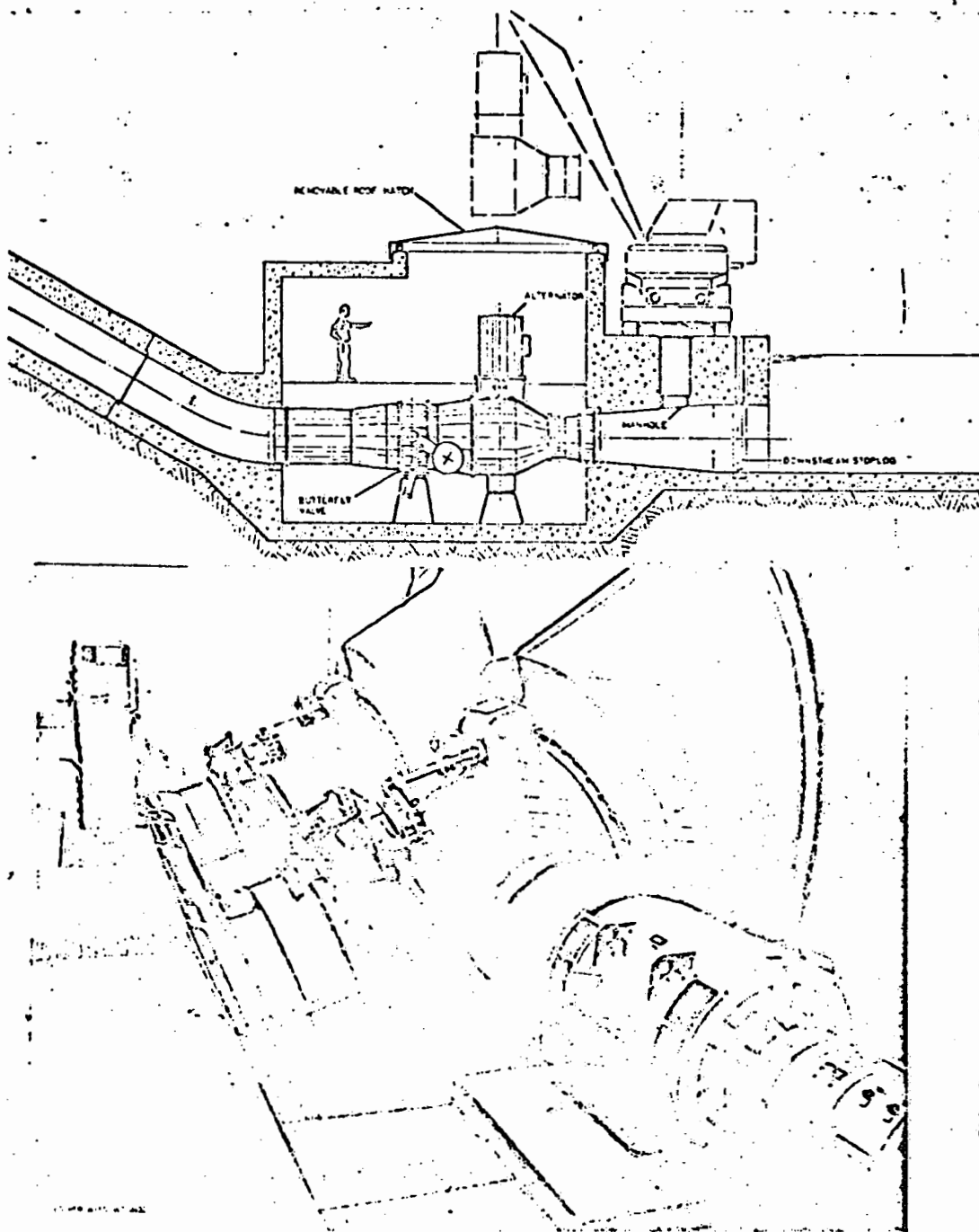
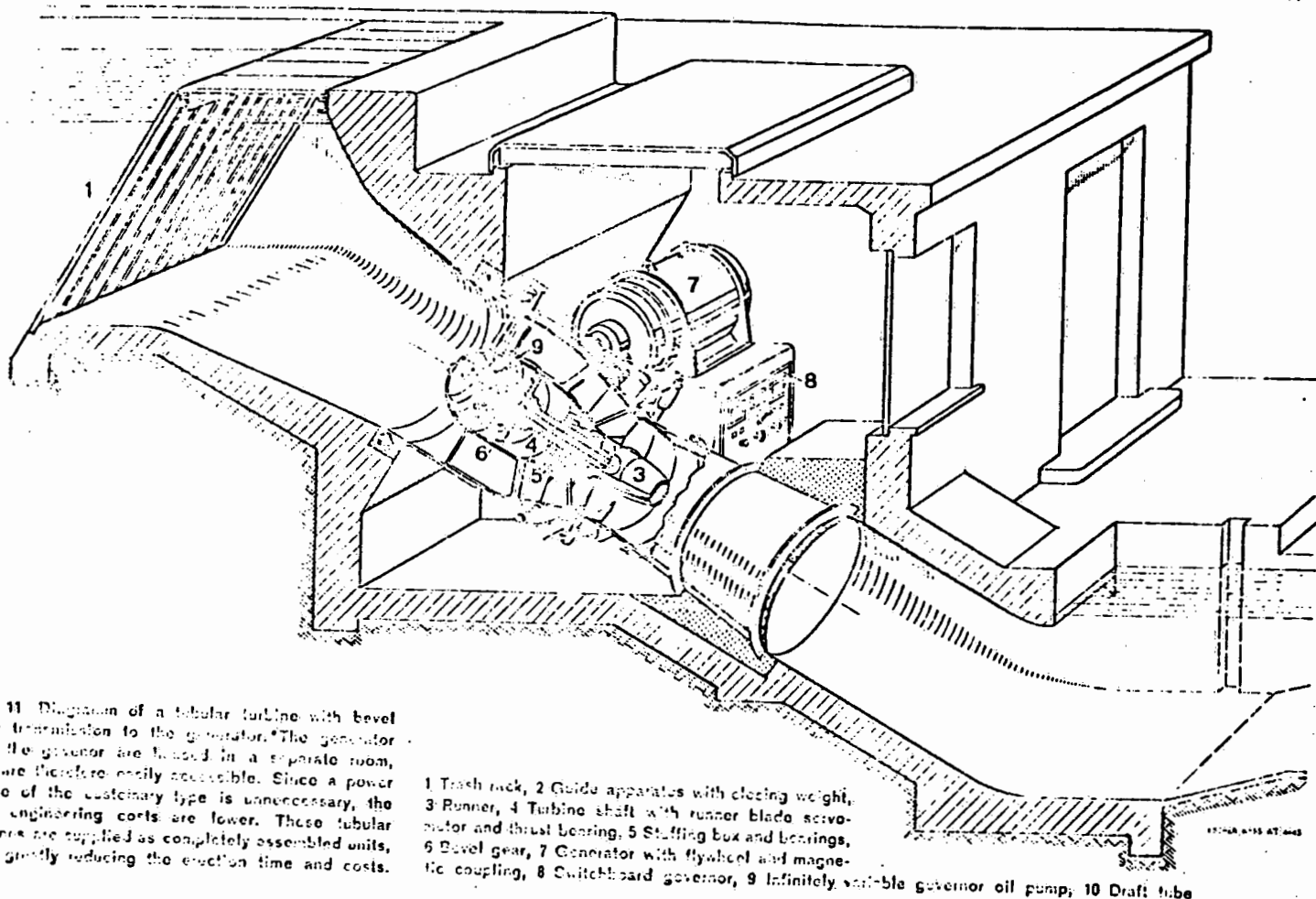


Fig. 10 A typical low-output tubular turbine plant with external generator for the economic utilisation of small sources of hydraulic power (Arlon Cotton Spinning Mill, Rietsingen/Radolfzell). Each unit develops 392 h.p. under a head of 4.0 metres. The generator is driven through bevel gears. The guide vanes in overhung arrangement permit complete shutting off of the inflowing water so that no valve is needed before the turbine. The guide apparatus is opened with oil under pressure, i.e. against the action of the closing weight.



In distinction to the bevel gear tube turbine, the so-called bulb type adapts a setting of the generator - with or without speed increasing gears - sensibly in the direct line of the water passageways. In this configuration, the generator may be either upstream or downstream of the runner. It seems, however, apparent that the upstream setting has been established as the standard since this design yields shorter dimensions and less weight, along with somewhat higher efficiency and greater ease of dismantling.

The primary consideration in locating the generator upstream is that one then has an overhung runner, and any questions of structural strength must be adequately met. Now in conjunction with this question, one of the virtues of the tubular design lies in its capability to provide symmetrical flow in either direction. Thus it can be used either as a turbine or a pump - in both directions. It can furthermore be used in the free flow mode, with blades and guide vanes desynchronized, to provide additional flow relief during times of flood.

The above flexibility of operation was not, however, possible until a new blade design had been developed. So until then, one way pump/turbine operation necessitated 215° blade rotation, with consequent non-overhung (i.e. downstream) runner. The development of new runner blades, however, made possible a pitch range of only 35° for the full range of operating possibilities. This situation - in regard to Neyrpic design - is given in the respective drawings below:

RECEIVED
JAN 10 1964
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
DENVER, COLORADO

CAMBEYRAC (French Electricity Authority - Massif Central Area - France)

Designed to produce 5150 kW at a head of 10.75 m, this was the first horizontal shaft Bulb unit suitable for operation as :

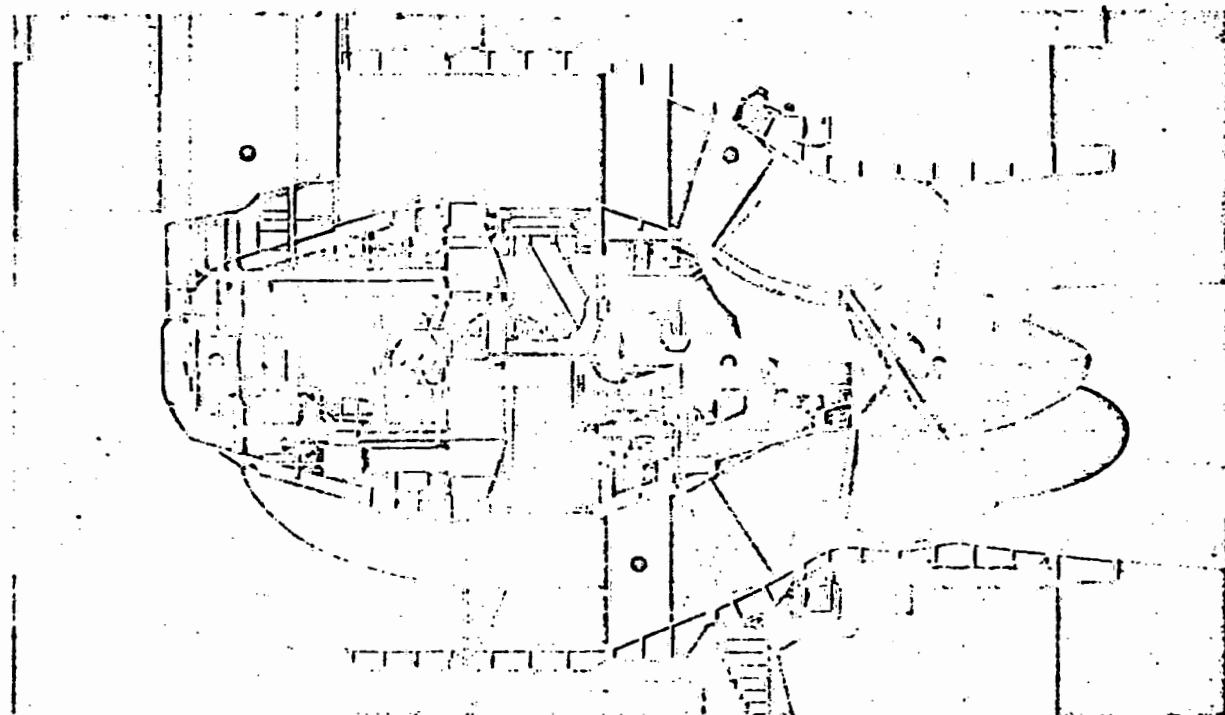
- a turbine in both directions of flow at heads of from 3 to 10.75 m.
 - a pump in both directions at heads of from 1 to 3 m.
- The machine comprises :
- a variable pitch runner and distributor producing 5150 kW at 10.75 m head. Flow : 55 m³/s. Speed : 150 r.p.m. Runner diameter : 3100 mm. Bulb diameter : 3400 mm;
 - one 3 phase 5400 kVA, 7300 Volt, 50 cycle, synchronous alternator running at 150 r.p.m. and mounted downstream of the turbine.

This machine was the first to be designed with a view to making use of the pumping possibilities suggested by model

tests, in connection with tidal power stations. The upstream Bulb arrangement could not be used since, at the time design work was being carried out, work on the runner blade sections was not yet complete and changing from one type of operation to another or reversing the direction of flow meant reversing the pitch of the runner blades by turning them through 215°. This resulted in a heavy and rather cumbersome runner hub and it was therefore felt advisable to avoid runner overhang by installing the alternator on the downstream side and by carrying the runner between 2 guide bearings.

Access is by a vertical shaft on the upstream side and by a horizontal passage in the streamlined strut on the downstream side. Cooling is by air, with the cooling surface around the alternator increased by fins inside the casing. (air is supplied at atmospheric pressure, i.e. 1 kg/cm² absolute, by external fans.)

COMMISSIONED 5th JULY 1957.



SAINT-MALO (French Electricity Authority - Brittany - France).

Designed to produce 6000 kW at a head of 4.8 m, this was the first full-scale tidal type Bulb unit capable of :

- two-way turbine operation at heads of from 1 to 11 m;
- two-way pump operation against a head from 1 to 6 m;
- two-way sluice operation.

Due to the development of special runner blades, a pitch range of only 35° is required for the full range of operating possibilities.

The similarity with Beaumont-Montoux is evident.

Turbine : 6000 kW at a head of 4.8 m. Flow : 350 m³/s. Runner diameter : 5800 mm. Bulb diameter : 5000 mm. Speed : 88.25 r.p.m.

Alternator : 9 MVA, 5.65 kV, 3 phase, running at 88.25 r.p.m.

A two bearing machine access is through a vertical shaft leading to the upstream end of the Bulb housing and through the interstices of the alternator rotor. Cooling is by air at atmospheric pressure and by finning on the Bulb cover. Air is circulated by a fan inside the Bulb cover nose.

COMMISSIONED, 4th NOVEMBER 1959.

LIST OF TURBINE MANUFACTURERS

Allis-Chalmers
York Plant
Hydro Turbine Division
Box 712
York, Pennsylvania 17405

Contact: E.A. Mayo (Manager)
Small Hydroelectric
Division

Allis-Chalmers claims to be the only major U.S. manufacturer of hydro-electric turbines. According to them, they manufacture mainly large custom-designed hydraulic turbines and generators. They build all three types of hydraulic turbines - Francis, Propeller and Impulse. These designs are custom-built to give their best performance with the engineering designed to suit local conditions. Also manufactured are all kinds of water control equipment; such as fixed wheel tainters, roller and bascule crest gates, submerged intake control gates for the tainter, fixed wheel and roller train types, control valves such as butterfly, bow, spherical or rotovalves for penstocks and free discharge valves of the Howell-Bunger and Ring Jet types.

In the 1950's Allis-Chalmers developed a low cost, simple low head hydro-electric unit making use of the maximum number of existing standardized components. It is claimed that this unit provides increased efficiency, a simplified water level or load control, increased capacity within a given unit size and reduced civil construction costs as compared to conventional vertical low head turbines.

Allis-Chalmers in cooperation with J.M. Voith of Germany, manufacture bulb-type turbines and have been bidding for all bulb type projects in the recent past.

Bharat Heavy Electricals, Ltd.
Export Division
10th Floor, New Delhi House, 27
Barakhamba Road
Post Box 218
New Delhi - 110001 India

Contact: J. Bhambhani (Manager)

Bharat Heavy Electricals claims to be one of the largest engineering and manufacturing organizations of its kind in the world. It also claims to be already in the top ten internationally, in terms of annual production of power plant equipment.

They have four manufacturing units designed to produce a complementary range of products to meet the entire needs of power generation, transmission, distribution and utilization.

Bharat Heavy Electricals engineers and manufactures hydro turbines of the Francis, Pelton and Kaplan types. They also manufacture hydro generators, reversible pump turbines, electro-hydraulic governors, exciters, valves and permanent magnet generators.

AB Bofors-Nohab
S-46101,
Trolhattan, Sweden

Contact: H. Sondahl
Hydro Power
Division

Nohab which is a division of AB Bofors can be considered to be one of the most experienced in the production of water turbines, having been producing them since 1847. They claim to have pioneered work along with ASEA on electro-hydraulic governors.

Since 1847 Nohab hydro power division has manufactured six types of turbines. These are Francis, Kaplan, Propeller, Diagonal, Tubular, and reversible pump turbines.

F.W.E. Stapenhorst Inc.
295 Labrosse Avenue
Ponte Claire, Que. H9R 1A3

Contact: F. Kanger, P.E.

F.W.E. Stapenhorst is the company which represents Osserberger-Turbinen Fabrik in Canada and the United States. The company supplies all engineering and equipment to form complete and integrated hydroelectric units, including the supervision of installation of equipment and final commission.

They manufacture the Osserberger turbine which is a radial, impulse-type turbine with partial admission.

Gilbert Gilkes & Gordon Ltd.
Kendal, Cumbria, England
LA9 7 BZ

Contact: N.B. Dawson
Sales Manager,
Water Turbines

Gilbert Gilkes & Gordon claims to have constructed more than 5000 impulse and reaction turbines. For the past thirty years most of their turbines have been Turgo Impulse Wheels.

The Turgo impulse wheel turbine was invented by the company in 1919. The Turgo impulse wheel is a very high capacity free jet impulse turbine.

Kossler Ges. m.b.h.
A-3151 St. Georgen-St.
Polten, Austria

Contact: E. Kossler

Kossler Engineering Works says that it has been planning and supplying equipment for small power stations for about half a century.

They manufacture the Impulse, Francis, Kaplan, Reiffenstein turbines, governors, gates, trash-rakes and weir flaps. They mainly manufacture the mechanical components of the hydroelectric unit.

INGRA
c/o American Equipment S.A.
Alvaro Obregon No. 286-Desp 416
Mexico 7 D.F.

To date, INGRA has not done any construction of any kind in the U.S. . They do however, have hydropower sites in Mexico and Canada. INGRA produces Francis, Kaplan and Pelton turbines. They have installed the Djerdap Dam in Yugoslavia and the Tarbela Dam in West Germany.

Charmilles-U.S. Representatives
c/o Curo-U.S.A. Co.
779 Barbara Avenue
Solana Beach, California 92075

Contact: Mr. Andre A. Baudat

The Charmilles Company produces Kaplan, Francis and Pelton turbines as well as axial and bulb turbines. The company is also doing a lot of work with vertical-shaft, multi-jet Pelton turbines of large output.

Canadian General Electric Company Ltd.
Post Office Box 347
795 First Avenue
Lachine, Quebec H8S 2 N0

Contact: R.S. Sproule, Manager
Hydro-Gen. Systems
Development

Canadian General Electric is interested, and sent us only a descriptive study that they had conducted. The report says that on a diversified system, updating old plant equipment can be economically justified.

ASEA
S-721 83
Vasteras, Sweden

Contact: Power Division,
Generation Department
Telex 4720
ASEAVA S

ASEA has reported to have bulb-type generators with efficiencies as high as 96% as opposed to Kaplan turbine which run at 93% efficiency.

The low speed capacity go up to 50 mega volt-amps and can be confined to smaller dams. There is no need for the usual power pit either.

The generators use a "micarex" insulating system which has good dimensional and thermal stability. The dielectric losses are also low.

The bulb unit can in theory be erected with main access through the Intake/Draft Tube. However for future servicing access must be done through a pit and an opening with a cover above the machine. It would make more sense to erect the machine through the same opening. There are nine steps to the construction of the machine.

ASEA also makes a static exciter which controls both the synchronous generator and voltage regulation. Other equipment is used for control and relay protection along with automatic control of Hydro-electric generator. They also have a series of mini-generators for use in single plants.

Mitsubishi Heavy Industries Ltd.
5-1 Marunvchi 2 Chrome,
Chiyoda-Ku
Tokyo, Japan

Contact: M. Nakaji, Manager
Power Systems Export
Division

Mitsubishi manufactured its first water turbine in 1914. Presently they manufacture all kinds of water turbines; Francis, Kaplan, Deriaz, Pelton, Tubular, and reversible pump turbines. They also manufacture all other equipment necessary for water turbines such as governors, pressure regulators, discharge valves, pressure oil and lubricating oil supply systems and control equipment for automatic control power plants.

Oy Tampella AB
Engineering Works Division
P.O.B. 267
S.F. - 33101 Tampere 10 Finland

Tampella Engineering Works has been manufacturing water turbines for over one hundred years. They manufacture Francis, Kaplan, Tubular and Pump turbines. Also they manufacture pumps, propellers, water control gates, intake gates, draft tube gates, trash racks and trash rack rakes. Hydraulic steel construction is also done by the company.

J.M. Voith GmbH
Postfach 1940
D-7920 Heidenheim
West Germany

J.M. Voith manufactures all kinds of water turbines. These include small-size standard turbines of the Kaplan, Pelton, Tube and Kaplan-Pump designs. They also manufacture all necessary components that go with the turbine. These include designs of butterfly, needle, spherical and dispersion valves; also radial, cylinder, sliding and roller gates, sluice gate flaps, bear-trap weirs, rack plants and rack cleaning machines. The company will design and manufacture to best suit the operating conditions.

Voest-Alpine
P.O. Box 2
A-4010 Linz/Donau
Austria

Contact: Spitaler/Flodl

Voest makes bulb turbine generators for dam heads as low as seven feet. They manufacture Francis, Francis-Pump, Pelton, and electro-hydraulic governors. In fact one of their major production lines is devoted to the design and production of governors. The company handles everything from design to the manufacture and installation of the turbine. Some of these installations are in Malawi, Norway, Zambia, Australia, Austria, Sudan, Nigeria and the United States.

Sulzer Brothers Inc.
19 Rector Street
New York, N.Y. 10006

Contact: B.E. Moser
Vice President

Sulzer Brothers Inc., which is a group that represents Bell Maschinenfabrik of Switzerland in the United States. Bell has been manufacturing and installing mechanical equipment for hydroelectric plants for over ninety years. They manufacture the Straflo (Straight Flow), Francis, and Pelton turbines, hydraulic test beds, butterfly and spherical valves. They have installed complete hydropower stations all over the world dating back to 1912 and as recently as 1976 in Guatemala.

SKODAEXPORT
Vaclavske n. 56
Praha 1 Czechoslovakia
P.O.B. 492

Contact: Ing. Frantisek Pommer
Chief of Department

SKODAEXPORT claims to be a leading manufacturer of water turbines in Czechoslovakia. They manufacture Francis, Kaplan, Pelton and Special turbines. The company can offer along with the delivery of a hydroelectric plant the necessary technical assistance, surveying, designing and installation of the complete water power plant. They have installed power plants in Czechoslovakia, Iceland, Korea, China, Bulgaria and Yugoslavia.

The James Leffel & Company
Springfield, Ohio 45501

Contact: Robert Groff, President

Leffel in existence for over one hundred years, celebrated their 115th anniversary year in 1977. The company has a wide variety of generators for low head dams, and will rebuild turbines providing any modifications to make the turbine up to sixteen percent more efficient. They manufacture and install Francis, Propeller and Impulse designed turbines; also vertical and horizontal shaft hydraulic turbines, trash racks and head gates and other related hydroelectric equipment.

Neyrpic, Inc.
50 Rockefeller Plaza
New York, N.Y. 10020

Contact: C. Haddad

Neyrpic in conjunction with Alsthom in France manufacture axial turbines for bulb units. Primarily they manufacture large bulb units, however, small units have also been designed and manufactured by the companies. They claim that the bulb unit has many technical and economic aspects which makes it preferable in many instances to other turbines. These technical and economic aspects are: its high performance, savings in structural work, and its comprehensive range of operating possibilities which include free flow, reverse flow and pumping, stability, easy maintenance and reliability.

Titovi Zavodi Litostroj
P.O. Box 308
Ljubljana, Jugoslavia

Litostroj claims to have manufactured all of the turbines which supply hydroelectric power in Yugoslavia. They manufacture Francis, Pelton, and Kaplan turbines, automatic speed and discharge governors, turbine shut-off valves, lubricating, cooling and draining devices, draft tube gates, head gates and their equipment. They have installed successfully hydroelectric turbines in the Near East, Asia, Africa, South America and New Zealand.

APPENDIX C

OFFICE OF ECONOMIC OPPORTUNITY

Information Center

Community Profile Data Sources

The Community Profile is a socio-economic report on the conditions of the county and its people. A separate English-language computer-generated report for the more than 3100 U. S. counties is available. This listing presents the data sources used in the preparation of the Profiles.

COMMUNITY PROFILE PROJECT DATA SOURCES

I. <u>Data Sources Used In Community Profile Project</u>	<u>Code</u>
a. Economic and demographic data: <u>County and City Data Book</u> , Bureau of the Census, 1952, 1956, and 1962.	CCDB
b. Business statistics: <u>County Business Patterns</u> , Bureau of the Census, 1962 and 1964.	CBP
c. Health and hospital data: <u>Health Manpower Source Book</u> , Section 19, Public Health Service, 1965.	HMP
d. 1960 poverty data: unpublished data compiled in the 1960 Census of Population.	PUD.
e. 1966 population and income estimates: <u>Sales Management</u> , Market Statistics Inc., 1967.	SM
f. Local government data: <u>Census of Governments</u> , Bureau of the Census, 1962.	CGOV
g. Mortality statistics: <u>Vital Statistics of the United States</u> , 1964, Public Health Service, 1966.	VS
h. Geographic data: <u>Rand McNally Commercial Atlas</u> , Rand McNally & Co., 1967.	RMCN
i. Geographic descriptions: <u>Economic Areas of the United States</u> , Free Press of Glencoe, Inc., 1961.	EA
j. Congressional data: <u>Congressional Directory</u> , Government Printing Office, 1967.	CD
k. County history: <u>American Counties</u> (revised edition), Joseph Nathan Kane, Scarecrow Press Inc., 1962.	AC

II. Data Variables Used In Community Profile Project

Listed on the following pages under the appropriate section titles are the names of the data variables as used in a general Community Profile. For a given Profile certain of the variables may not be applicable and may not have been discussed.

For each line of data there is a:

- 4-digit variable number as identified in the data-bank
- Name of variable, which includes date of reference
- Code of data source, as defined above
- An indication as to whether original data item was manipulated:
 - T - data was transformed from source (e.g. changed to percent)
 - S - data is as given in original source

POVERTY INDICATORS

1258 PERCENTILE, NUMBER OF HOUSEHOLDS BELOW POV. CUTOFF - 1966	SM	T
1275 PERCENTILE, % OF HOUSEHOLDS BELOW POV. CUTOFF - 1966	SM	T
3202 PRCTILE, AV QUARTERLY WAGE REPORTED BY BUS ESTABLISHMENTS - 1964	CRP	T
3203 PERCENTILE, PER CAPITA RETAIL SALES - 1966	SM	T
3199 PERCENTILE, MEDIAN HOUSEHOLD INCOME - 1966	SM	T
3205 PERCENTILE, % UNEMPLOYED IN THE LABOR FORCE - 1960	CCDB	T
3208 PRCTILE, MEDIAN SCHL YRS. COMPLETED BY PRSNS 25 YRS. OR OVER - 1960	CCDB	T
3033 PERCENTILE, % 25 YRS. AND OVER COMP. LESS THAN 5 YRS. OF SCH - 1960	CCDB	T
3211 PERCENTILE, DOCTORS PER 1000 POPULATION - 1962	HMP	T
3225 PERCENTILE, INFANT MORTALITY RATE - 1964	VS	S
3277 PERCENTILE, % OF DWELLINGS WITH OVER 1 PERSON PER ROOM - 1960	CCDB	T
3204 PERCENTILE, FARMER LEVEL-OF-LIVING INDEX - 1960	CCDB	T
3123 TOTAL FAMILIES BELOW POVCUT - 1966	SM	T
3137 % OF 1966 POOR OF COUNTY POP, HOUSEHOLDS	SM	T
3195 AVERAGE QUARTERLY WAGE REPORTED BY BUSINESS ESTABLISHMENTS - 1964	CRP	S
3196 PER CAPITA RETAIL SALES - 1966	SM	S
3192 MEDIAN HOUSEHOLD INCOME - 1966	SM	T
3198 % UNEMPLOYED IN THE LABOR FORCE - 1960	CCDB	S
3206 MEDIAN SCHOOL YRS. COMPLETED BY PERSONS 25 YRS. OR OVER - 1960	CCDB	S
2259 % POP. 25 OR OVER COMPLETING LESS THAN 5 YRS. OF SCHOOL - 1960	CCDB	S
3210 DOCTORS PER 1000 POPULATION - 1962	HMP	T
3221 INFANT MORTALITY RATE - 1964	VS	T
2274 % UNITS WITH 1.01 OR MORE PERSONS/ROOM - 1960	CCDB	S
3197 FARMER LEVEL-OF-LIVING INDEX - 1959	CCDB	S

PROFILE OF THE POOR

DEFINITION OF POVERTY

3120 DOLLAR VALUE OF POVCUT - 1960	PUN	T
3121 DOLLAR VALUE OF POVCUT - 1966	SM	T

LEVEL OF POVERTY

3125 TOTAL 1966 HOUSEHOLDS	SM	S
3123 TOTAL FAMILIES BELOW POVCUT - 1966	SM	T
3137 % OF 1966 POOR OF COUNTY POP, HOUSEHOLDS	SM	T
3128 STATE TOTAL HOUSEHOLDS - 1966	SM	S
3224 STATE TOTAL HOUSEHOLDS BELOW POVCUT - 1966	SM	T
3024 % STATE POOR OF TOTAL STATE POP, 1966 - FAMILIES	SM	T
3301 CTY % OF STATE POP - 1966	SM	T
3320 % CTY POOR OF STATE POOR - 1966 - XX.X	SM	T
3319 % CTY POOR OF STATE POP - 1966 - XX.X	SM	T
3303 STATE % OF USA POP - 1960	CCDB	T
3324 % STATE POOR OF USA POOR - 1966 - XX.X	SM	T
3323 % STATE POOR OF USA POP - 1966 - XX.X	SM	T

CHANGES IN THE POVERTY LEVEL

3124 TOTAL 1960 FAMILIES	CCDB	S
3122 TOTAL FAMILIES BELOW POVCUT - 1960	CCDB	T
3136 % OF 1960 POOR OF COUNTY POP, FAMILIES	CCDB	T

2337 RATE OF CHANGE OF CTY. POOR FAMILY POP, 1960-1966	CCDR	T
2336 RATE OF CHANGE OF CTY. FAMILY POP, 1960-1966	SM	T
00 CTY % OF STATE POP - 1960	CCDR	T
2286 STATE TOTAL FAMILIES - 1960	CCDR	S
3318 % CTY POOR OF STATE POOR - 1960 - XX.X	PUD	T
3292 STATE TOTAL FAMILIES BELOW POVCUT - 1960	PUD	T

SEVERITY OF POVERTY

1275 PERCENTILE, % OF HOUSEHOLDS BELOW POV. CUTOFF - 1966	SV	T
1260 PERCENTILE, % OF FAMILIES BELOW POV. CUTOFF - 1960	PUD	T

MAGNITUDE OF POVERTY

1258 PERCENTILE, NUMBER OF HOUSEHOLDS BELOW POV. CUTOFF - 1966	SV	T
1152 PERCENTILE, NUMBER OF FAMILIES BELOW POV. CUTOFF - 1960	PUD	T

CHARACTERISTICS OF THE POOR POPULATION

3158 1960 % OF POP. U-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3163 1960 % OF POP. R-E-NW, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3166 1960 % OF TOTAL POOR, U-W POOR, COUNTY FAMILIES	PUD	T
3151 1960 % OF TOTAL POOR, R-E-NW POOR, COUNTY FAMILIES	PUD	T
3164 1960 % OF POP. U-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3167 1960 % OF POP. U-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
1148 1960 % TOTAL POP., URBAN POOR FAMILIES	CCDR	T
3140 1960 U-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
3163 1960 U-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
1238 TOTAL URBAN FAMILIES BELOW POV. CUT., 1960	PUD	T
158 1960 % OF POP. U-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
161 1960 % OF POP. U-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3335 1960 % TOTAL POP., URBAN FAMILIES	CCDR	S
3152 1960 NO. OF TOTAL POP. U-W, COUNTY FAMILIES	PUD	S
3155 1960 NO. OF TOTAL POP. U-W, COUNTY FAMILIES	PUD	S
3338 1960 NO. URBAN FAMILIES	CCDR	T
3165 1960 % OF POP. R-N-E-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3168 1960 % OF POP. R-N-E-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
1147 1960 % TOTAL POP., RNF FAMILIES	CCDR	T
3141 1960 R-N-E-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
3134 1960 R-N-E-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
1229 TOTAL RURAL FAMILIES BELOW POV. CUT., 1960	PUD	T
3159 1960 % OF POP. R-N-E-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3162 1960 % OF POP. R-N-E-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3336 1960 % TOTAL POP., RNF FAMILIES	CCDR	S
3153 1960 NO. OF TOTAL POP. R-N-E-W, COUNTY FAMILIES	PUD	S
3156 1960 NO. OF TOTAL POP. R-N-E-W, COUNTY FAMILIES	CCDR	T
3339 1960 NO. RNF FAMILIES	CCDR	T
3166 1960 % OF POP. R-E-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3169 1960 % OF POP. R-E-W BELOW POVCUT, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
1150 1960 % TOTAL POP., RF FAMILIES	CCDR	T
3142 1960 R-E-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
3145 1960 R-E-W BELOW POVCUT, COUNTY FAMILIES	PUD	S
1240 TOTAL RURAL FARM FAMILIES BELOW POV. CUT., 1960	PUD	T
3160 1960 % OF POP. R-E-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T
3163 1960 % OF POP. R-E-W, CTY FAMILIES OF TOTAL FAMILIES	PUD	T

3337 1960 % TOTAL POP., RE FAMILIES	CCDB S
3154 1960 NO. OF TOTAL POP. R-F-W, COUNTY FAMILIES	PUD S
57 1960 NO. OF TOTAL POP. R-F-NW, COUNTY FAMILIES	PUD S
10 1960 NO. RE FAMILIES	CCDB T
3178 1960 % OF POOR WHITE OF TOTAL POP.	PUD T
3179 1960 % POOR NON-WHITE OF TOTAL POP.	PUD T
3136 % OF 1960 POOR OF COUNTY POP, FAMILIES	PUD T
3170 1960 NO. OF POOR WHITE FAMILIES	PUD S
3171 1960 NO. OF POOR NON-WHITE FAMILIES	PUD S
3122 TOTAL FAMILIES BELOW POVCUT - 1960	PUD S
3176 1960 % OF WHITE FAMILIES - COUNTY	PUD T
3177 1960 % OF NON-WHITE FAMILIES - COUNTY	PUD T
3174 1960 NO. OF FAMILIES - WHITE - COUNTY	PUD S
3175 1960 NO. OF FAMILIES NON-WHITE - COUNTY	PUD S
3124 TOTAL 1960 FAMILIES	CCDB S

G E O G R A P H I C P R O F I L E

REGIONAL CHARACTERISTICS

2213 COMPASS QUADRANT CODE	RMCN S
2223 CENSUS DIVISION CODE	CCDB S
3214 STATE TOTAL POPULATION - 1960 - THOUSANDS	CCDB S
3303 STATE % OF USA POP - 1960	CCDB T
3300 CTY % OF STATE POP - 1960	CCDB T
2144 TOTAL COUNTY POPULATION - 1966	SM S
3222 STATE TOTAL URBAN POP - 1966	SM S
3310 STATE % OF URBAN OF USA URBAN POP - 1960	CCDB T
3307 CTY % OF STATE URBAN POP - 1966	SM T
35 URBAN POPULATION - 1966	SM T
3404 CTY % OF STATE RETAIL SALES - 1966	SM T
1331 TOTAL RETAIL SALES - 1965	SM S
2016 PER CAPITA DISPOSABLE INCOME - 1966	SM S

REGIONAL CLIMATE AND TERRAIN

2214 ECONOMIC SUBREGION CODE	EA S
2216 NUMERIC SEA CODE	EA S

REGIONAL TRADING AREAS

2211 BASIC TRADING AREA CODE	RMCN S
2212 MAJOR TRADING AREA CODE	RMCN S

BOUNDARIES AND AREA

2131 TOTAL COUNTY LAND AREA, SQ. MI.	CCDB S
2159 % TOTAL COUNTY AREA IN URBAN PLACES, 1960, CAN BE 100%	CCDB T
2113 CITIES IN & ON CTY GRTR 2.5K POP., AREA IN SQ. MI.	CCDB S
2230 % URBAN LAND AREA OCCUPIED BY LARGEST CITY - 1960	CCDB T
2110 LARGEST CITY IN COUNTY, AREA IN SQUARE MILES	CCDB S

ADMINISTRATION AND COUNTY GOVERNMENT

DATE OF ESTABLISHMENT

AC S

CONGRESSIONAL REPRESENTATION AND STATE GOVERNMENT

2192 STATE AND CONG. DIST., TABLE ARG., 1ST 5-DIGIT CODE

CD S

2175 CONGRESSIONAL DISTRICT, 1ST 2-DIGIT CODE

CD S

2209 NUMBER OF INCLUDED OR INCLUDING CONG. DISTRICTS

CD S

DEMOGRAPHIC PROFILE

DISTRIBUTION OF POPULATION

2144 TOTAL COUNTY POPULATION - 1966

SM S

2146 % URBAN - 1966

SM T

2145 TOTAL COUNTY URBAN POPULATION - 1966

SM S

2226 % RURAL - 1966

SM T

2236 TOTAL RURAL POPULATION - 1966

SM S

2235 % RURAL POPULATION - 1960

CCDB T

2134 % URBAN POPULATION, 1960, SOURCE DATA, NOT CITY TOTAL

CCDB S

URBAN PLACES

2111 CITIES IN & ON CITY GRTR 2.5K POP. - 1960

CCDB S

2134 % URBAN POPULATION, 1960, SOURCE DATA, NOT CITY TOTAL

CCDB S

2115 NUMBER OF PLACES, 1960 POP. GREATER THAN 2.5 K, LESS THAN 10.0 K

CCDB S

2123 TOTAL 1960 POP. IN PLACES GREATER THAN 2.5 K, LESS THAN 10.0 K

CCDB S

2140 % TOTAL 1960 POP. IN PLACES GREATER THAN 2.5 K, LESS THAN 10.0 K

CCDB T

6 NUMBER OF PLACES, 1960 POP. GREATER THAN 10.0 K, LESS THAN 25.0 K

CCDB S

2124 TOTAL 1960 POP. IN PLACES GREATER THAN 10.0 K, LESS THAN 25.0 K

CCDB S

2161 % TOTAL 1960 POP. IN PLACES GREATER THAN 10.0 K, LESS THAN 25.0 K

CCDB T

2118 NUMBER OF PLACES, 1960 POP. GREATER THAN 25.0 K, LESS THAN 50.0 K

CCDB S

2126 TOTAL 1960 POP. IN PLACES GREATER THAN 25.0 K, LESS THAN 50.0 K

CCDB S

2163 % TOTAL 1960 POP. IN PLACES GREATER THAN 25.0 K, LESS THAN 50.0 K

CCDB T

2119 NUMBER OF PLACES, 1960 POP. GREATER THAN 50.0 K, LESS THAN 100.0 K

CCDB S

2127 TOTAL 1960 POP. IN PLACES GREATER THAN 50.0 K, LESS THAN 100.0 K

CCDB S

2164 % TOTAL 1960 POP. IN PLACES GREATER THAN 50.0 K, LESS THAN 100.0 K

CCDB T

2120 NUMBER OF PLACES, 1960 POP. GREATER THAN 100.0 , LESS THAN 500.0 K

CCDB S

2128 TOTAL 1960 POP. IN PLACES GREATER THAN 100.0 K, LESS THAN 500.0 K

CCDB S

2165 % TOTAL 1960 POP. IN PLACES GREATER THAN 100.0 K, LESS THAN 500.0 K

CCDB T

2121 NUMBER OF PLACES, 1960 POP. GREATER THAN 500.0 , LESS IN 1,000.0 K

CCDB S

2129 TOTAL 1960 POP. IN PLACES GREATER THAN 500.0 K, LESS THAN 1,000.0 K

CCDB S

2166 % TOTAL 1960 POP. IN PLACES GREATER THAN 500.0 K, LESS IN 1,000.0 K

CCDB T

2122 NUMBER OF PLACES, 1960 POP. GREATER THAN 1,000.0

CCDB S

2130 TOTAL 1960 POP. IN PLACES GREATER THAN 1,000.0 K

CCDB S

2167 % TOTAL 1960 POP. IN PLACES GREATER THAN 1,000.0 K

CCDB T

2108 LARGEST CITY IN COUNTY, 1960 POPULATION

CCDB S

2229 % COUNTY POPULATION IN LARGEST CITY - 1960

CCDB T

2227 % URBAN IN LARGEST CITY - 1960

CCDB T

POPULATION DENSITY

2147 POPULATION DENSITY, 1966, PERS. PER SQ. MI.

SM T

2150 PERCENTILE RANK, POP. DENSITY - 1960	SM	T
2133 COUNTY POPULATION DENSITY, 1960, PERSONS PER SQ. MI.	CCDB	S
2137 COUNTY POPULATION DENSITY, 1950 PERS. PER SQ. MI.	CCDB	S

POPULATION CHANGE

2136 TOTAL COUNTY POPULATION - 1950	CCDB	S
2132 TOTAL COUNTY 1960 POPULATION	CCDB	S
2144 TOTAL COUNTY POPULATION - 1966	SM	S
2291 % INCREASE/DECREASE POPULATION - 1940-50	CCDB	S
2244 % INCREASE/DECREASE POPULATION - 1950-60	CCDB	S
3024 % INCREASE/DECREASE POPULATION - 1960-66	SM	T
1125 TOTAL POPULATION CHANGE 1950 - 1960	CCDB	T
1127 % RATE OF INCREASE - MIGRATION 1950 - 1960	CCDB	S
2265 NET GAIN/LOSS THROUGH CIVILIAN MIGRATION - 1950-60	CCDB	S
1126 NATURAL INCREASE 1950 - 1960	CCDB	T
1128 % RATE OF NATURAL INCREASE 1950 - 1960	CCDB	S
2320 NATURAL INCREASE, LIVE BIRTHS--DEATHS - 1960	CCDB	T
2322 NATURAL INCREASE, LIVE BIRTHS--DEATHS - 1950	CCDB	T
2321 % NATURAL INCREASE OF POPULATION - 1960	CCDB	T
2323 % POPULATION NATURAL INCREASE - 1950	CCDB	T

POPULATION CHARACTERISTICS

3019 % POPULATION NONWHITE - 1966	SM	S
3020 % NEGRO OF NONWHITE POPULATION - 1966	SM	T
3233 PERCENTILE, % POPULATION NONWHITE - 1966	SM	T
2248 % POPULATION NONWHITE - 1960	CCDB	S
2292 % POPULATION NONWHITE - 1950	CCDB	S
1122 MEDIAN AGE - 1966	SM	S
1152 MEDIAN AGE - 1960	CCDB	S
2299 MEDIAN AGE - 1950	CCDB	S
3015 % POPULATION AGED, 0-5 YRS. - 1966	SM	S
2249 % POPULATION UNDER 5 YRS. - 1960	CCDB	S
2327 % POPULATION UNDER 5 YRS. AGE - 1950	CCDB	S
3016 % POPULATION AGED, 65 AND OVER - 1966	SM	S
2251 % POPULATION 65 AND OVER - 1960	CCDB	S
2328 % POPULATION 65 YRS. AND OVER - 1950	CCDB	S
1101 % POPULATION 0-5 - 1966	SM	T
1102 % POPULATION 6-11 - 1966	SM	T
1103 % POPULATION 12-17 - 1966	SM	T
1104 % POPULATION 18-24 - 1966	SM	T
1105 % POPULATION 25-34 - 1966	SM	T
1106 % POPULATION 35-49 - 1966	SM	T
1107 % POPULATION 50-64 - 1966	SM	T
1108 % POPULATION 65-UP - 1966	SM	T

ECONOMIC PROFILE

BUSINESS ESTABLISHMENTS - EMPLOYEES AND PAYROLLS

1001 TOTAL NUMBER OF EMPLOYEES - 1962	CRP	S
1133 TOTAL NUMBER OF EMPLOYEES - 1964	CRP	S
1265 % CHANGE OF TOTAL EMPLOYMENT, 1962 - 1964	CRP	T

1147	% OF PEOPLE EMPLOYED IN AGRICULTURAL SERVICES - 1964	CRP	T
115	% OF PEOPLE EMPLOYED IN AGRICULTURAL SERVICES - 1962	CRP	T
1157	% OF PEOPLE EMPLOYED IN MINING - 1964	CRP	T
1025	% OF PEOPLE EMPLOYED IN MINING - 1962	CRP	T
1167	% OF PEOPLE EMPLOYED IN CONTRACT CONST. - 1964	CRP	T
1035	% OF PEOPLE EMPLOYED IN CONTRACT CONST. - 1962	CRP	T
1177	% OF PEOPLE EMPLOYED IN MANUFACTURING - 1964	CRP	T
1045	% OF PEOPLE EMPLOYED IN MANUFACTURING - 1962	CRP	T
1187	% OF PEOPLE EMPLOYED IN TCEGS SERVICES - 1964	CRP	T
1055	% OF PEOPLE EMPLOYED IN TCEGS SERVICES - 1962	CRP	T
1197	% OF PEOPLE EMPLOYED IN WHOLESALE TRADE - 1964	CRP	T
1065	% OF PEOPLE EMPLOYED IN WHOLESALE TRADE - 1962	CRP	T
1207	% OF PEOPLE EMPLOYED IN RETAIL TRADE - 1964	CRP	T
1075	% OF PEOPLE EMPLOYED IN RETAIL TRADE - 1962	CRP	T
1217	% OF PEOPLE EMPLOYED IN FINANCE, INS. & R. ESTATE - 1964	CRP	T
1085	% OF PEOPLE EMPLOYED IN FINANCE, INS. & R. ESTATE - 1962	CRP	T
1227	% OF PEOPLE EMPLOYED IN SERVICES - 1964	CRP	T
1095	% OF PEOPLE EMPLOYED IN SERVICES - 1962	CRP	T
1242	% NONCLASSIFIABLE ESTABLISHMENTS EMPLOYEES OF TOTAL - 1964	CRP	T
1110	% NONCLASSIFIABLE ESTABLISHMENTS EMPLOYEES OF TOTAL - 1962	CRP	T
1276	INDEX OF LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1243	NUMBER OF EMPLOYEES IN THE LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1244	% OF EMPLOYEES IN THE LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1245	% COUNTY TAXABLE PAYROLL OF THE LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1247	NUMBER OF EMPLOYEES IN THE SECOND LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1248	% OF EMPLOYEES IN THE SECOND LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1249	% COUNTY TAX. PAYROLL OF THE 2ND LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1251	NUMBER OF EMPLOYEES IN THE 3RD LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1252	% OF EMPLOYEES IN THE THIRD LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1253	% COUNTY TAX. PAYROLL OF THE 3RD LARGEST INDUSTRY EMPLOYER - 1964	CRP	T
1261	NUMBER OF EMPLOYEES IN THE THREE LARGEST EMPLOYERS - 1964	CRP	T
1263	% OF PEOPLE EMPLOYED IN THE THREE LARGEST INDUSTRIES - 1964	CRP	T
1262	TAXABLE PAYROLL IN THE THREE LARGEST EMPLOYERS - 1964	CRP	T
1264	% OF TAXABLE PAYROLL IN THE THREE LARGEST INDUSTRIES - 1964	CRP	T
1270	INDEX OF LARGEST INDUSTRY EMPLOYER - 1962	CRP	T
1111	NUMBER OF EMPLOYEES IN THE LARGEST INDUSTRY EMPLOYER - 1962	CRP	S
1112	% OF EMPLOYEES IN THE LARGEST INDUSTRY EMPLOYER - 1962	CRP	S
1113	% COUNTY TAXABLE PAYROLL OF THE LARGEST INDUSTRY EMPLOYER - 1962	CRP	S
1115	NUMBER OF EMPLOYEES IN THE SECOND LARGEST INDUSTRY EMPLOYER - 1962	CRP	S
1116	% OF EMPLOYEES IN THE SECOND LARGEST INDUSTRY EMPLOYER - 1962	CRP	T
1117	% COUNTY TAX. PAYROLL OF THE 2ND LARGEST INDUSTRY EMPLOYER - 1962	CRP	T
1119	NUMBER OF EMPLOYEES IN THE 3RD LARGEST INDUSTRY EMPLOYER - 1962	CRP	S
1120	% OF EMPLOYEES IN THE THIRD LARGEST INDUSTRY EMPLOYER - 1962	CRP	T
1121	% COUNTY TAX. PAYROLL OF THE 3RD LARGEST INDUSTRY EMPLOYER - 1962	CRP	T
1129	NUMBER OF EMPLOYEES IN THE THREE LARGEST EMPLOYERS - 1962	CRP	T
1131	% OF PEOPLE EMPLOYED IN THE THREE LARGEST INDUSTRIES - 1962	CRP	T
1130	TAXABLE PAYROLL IN THE THREE LARGEST EMPLOYERS - 1962	CRP	T
1132	% OF TAXABLE PAYROLL IN THE THREE LARGEST INDUSTRIES - 1962	CRP	T
1276	INDEX OF LARGEST INDUSTRY EMPLOYER - 1964	CCDB	S
1135	TOTAL NUMBER OF REPORTING UNITS - 1964	CRP	S
3315	CTY % REPORTING INDUS. UNITS - 1962	CRP	T
1003	TOTAL NUMBER OF REPORTING UNITS - 1962	CRP	S
3316	CTY % REPORTING INDUS. UNITS - 1964	CCDB	S
1267	DIFFERENCE IN NUMBER OF REPORTING UNITS, 1962 - 1964	CRP	T
1139	% OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 0-19 - 1964	CRP	T

1007 % OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 0-19 - 1962	CRP	T
40 % OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 20-99 - 1964	CRP	T
1008 % OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 20-99 - 1962	CRP	T
1141 % OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 1000 - 1964	CRP	T
1009 % OF COUNTY INDUSTRY IN INDUSTRIES IN SIZE CLASS 1000 - 1962	CRP	T
1002 TAXABLE PAYROLLS - 1962	CRP	T
1134 TAXABLE PAYROLLS - 1964	CRP	T
1266 % CHANGE IN TOTAL TAXABLE PAYROLL, 1962 - 1964	CRP	T
1142 AVERAGE QUARTERLY GROSS EARNINGS, JANUARY-MARCH PAY PERIOD - 1964	CRP	T
1010 AVERAGE QUARTERLY GROSS EARNINGS, JANUARY-MARCH PAY PERIOD - 1962	CRP	T
3270 PERCENTILE, TOTAL QUARTERLY TAXABLE PAYROLL IN \$1000 - 1964	CRP	T
3272 PERCENTILE, TOTAL QUARTERLY TAXABLE PAYROLL IN \$1000 - 1962	CRP	T
3236 AVERAGE QUARTERLY WAGE - 1964 CRP - FILE RANK	CRP	T
3238 PERCENTILE, AVERAGE QUARTERLY WAGE - 1962 CRP	CRP	T
1279 INDEX OF INDUSTRY WITH SMALLEST AV. QTRLY GROSS EARNINGS - 1964	CRP	T
1256 AV. QTRLY GROSS EARNINGS WITH LOWEST AV. QTRLY GROSS EARN. - 1964	CRP	T
1255 NO. OF EMPLOYEES IN INDUS. WITH LOWEST AV. QTRLY GROSS EARN. - 1964	CRP	S
1124 AV. QTRLY GROSS EARNINGS IN LOWEST AV. QTRLY GROSS EARN. - 1962	CRP	T
1273 INDEX OF INDUSTRY WITH SMALLEST AV. QTRLY GROSS EARNINGS - 1962	CRP	T
1123 NO. OF EMPLOYEES IN INDUS. WITH LOWEST AV. QTRLY GROSS EARN. - 1962	CRP	T
1146 AVERAGE FIRST QUARTER GROSS EARNINGS IN AGRIC. SERVS. - 1964	CRP	T
1147 % OF PEOPLE EMPLOYED IN AGRICULTURAL SERVICES - 1964	CRP	T
1156 AVERAGE FIRST QUARTER GROSS EARNINGS IN MINING - 1964	CRP	T
1157 % OF PEOPLE EMPLOYED IN MINING - 1964	CRP	T
1166 AVERAGE FIRST QUARTER GROSS EARNINGS IN CONTRACT CONST. - 1964	CRP	T
1167 % OF PEOPLE EMPLOYED IN CONTRACT CONST. - 1964	CRP	T
1176 AVERAGE FIRST QUARTER GROSS EARNINGS IN MANUFACTURING - 1964	CRP	T
1177 % OF PEOPLE EMPLOYED IN MANUFACTURING - 1964	CRP	T
86 AVERAGE FIRST QUARTER GROSS EARNINGS IN TCEGS SERVICES - 1964	CRP	T
87 % OF PEOPLE EMPLOYED IN TCEGS SERVICES - 1964	CRP	T
1196 AVERAGE FIRST QUARTER GROSS EARNINGS IN WHOLESALE TRADE - 1964	CRP	T
1197 % OF PEOPLE EMPLOYED IN WHOLESALE TRADE - 1964	CRP	T
1206 AVERAGE FIRST QUARTER GROSS EARNINGS IN RETAIL TRADE - 1964	CRP	T
1207 % OF PEOPLE EMPLOYED IN RETAIL TRADE - 1964	CRP	T
1216 AV. QTRLY GROSS EARNINGS IN FINANCE, INS. & R. ESTATE - 1964	CRP	T
1217 % OF PEOPLE EMPLOYED IN FINANCE, INS. & R. ESTATE - 1964	CRP	T
1226 AVERAGE QUARTERLY GROSS EARNINGS IN SERVICES - 1964	CRP	T
1227 % OF PEOPLE EMPLOYED IN SERVICES - 1964	CRP	T

CHARACTERISTICS OF THE LABOR FORCE

1305 TOTAL CIVILIAN LABOR FORCE - 1960	CCDR	S
2076 TOTAL EMPLOYED - 1960	CCDR	S
2078 TOTAL UNEMPLOYED - 1960	CCDR	T
1306 SHIFT IN TOTAL POPULATION, 1950-1960, %	CCDR	S
1327 % CHANGE, TOTAL CIVILIAN LABOR FORCE, 1950-1960	CCDR	T
1308 % UNEMPLOYED - 1960	CCDR	S
3240 PERCENTILE, % UNEMPLOYED - 1960	CCDR	T
2080 % UNEMPLOYED - 1950	CCDR	T
1309 % WHITE COLLAR WORKERS - 1960	CCDR	S
1307 % TOTAL CIVILIAN LABOR FORCE, MALE - 1960	CCDR	S
1330 % TOTAL CIVILIAN LABOR FORCE, MALE - 1950	CCDR	S
1310 % EMPLOYEES RESIDING INSIDE, WORKING OUTSIDE COUNTY - 1960	CCDR	S

AGRICULTURE

195	NUMBER OF FARMS - 1959	CCDR S
188	RATIO CHANGE # FARMS 1959/1954	CCDR T
2087	% SMALL, LESS THAN 10 ACRES, FARMS OF ALL FARMS 1959	CCDR T
1298	AVERAGE ACREAGE PER FARMS - 1959	CCDR S
1294	% LAND IN FARMS - 1959	CCDR S
1320	% CHANGE, LAND IN FARMS, 1954-1959	CCDR T
3258	PERCENTILE, % LAND IN FARMS - 1960	CCDR T
1296	NUMBER OF COMMERCIAL FARMS - 1959	CCDR S
2085	% COMMERCIAL FARMS LESS THAN \$2,500 - 1959	CCDR T
1299	AVERAGE VALUE PER FARM OF LAND AND BUILDINGS - 1959	CCDR S
1297	% TENANT-OPERATED FARMS - 1959	CCDR S
1300	TOTAL VALUE OF FARM PRODUCTS SOLD - 1959	CCDR S
1322	ALL CROPS % OF TOTAL VALUE OF FARM PRODUCTS SOLD - 1959	CCDR T
1323	DAIRY PRODUCTS % OF TOTAL VALUE OF FARM PRODUCTS SOLD - 1959	CCDR T
1324	POULTRY, POULTRY PRODUCTS % TOTAL VALUE OF FARM PROD. SOLD - 1959	CCDR T
1325	LIVESTOCK AND PRODUCTS % TOTAL VALUE OF FARM PRODUCTS SOLD - 1959	CCDR T
1301	LEVEL-OF-LIVING INDEX, FARM-OPERATOR FAMILY - 1959	CCDR S
3260	PERCENTILE, FARMER LEVEL INDEX - 1959	CCDR T
1302	% OF FARMS WITH TELEPHONES - 1959	CCDR S
1303	% OF FARMS WITH TRACTORS - 1959	CCDR S
1304	% OF FARMS WITH MOTOR TRUCKS - 1959	CCDR S

WHOLESALE TRADE

1290	NUMBER OF WHOLESALE ESTABLISHMENTS - 1958	CCDR S
1291	TOTAL WHOLESALERS, DOLLARS - 1958	CCDR S
1314	% CHANGE IN WHOLESALE SALES, 1954-1958	CCDR T
315	% MERCHANT OF TOTAL WHOLESALE ESTABLISHMENTS - 1958	CCDR T
16	% MERCHANT OF TOTAL WHOLESALE DOLLAR VALUE - 1958	CCDR T
1317	SALES VOLUME PER WHOLESALE ESTABLISHMENTS - 1958	CCDR T
1292	TOTAL PAYROLL, WHOLESALE - 1958	CCDR S

RETAIL TRADE

1331	TOTAL RETAIL SALES - 1965	CCDR S
1332	RETAIL SALES PER CAPITA - 1965	CCDR T
3262	PERCENTILE, PER CAPITA RETAIL SALES - 1966	SM T
1333	% TOTAL RETAIL SALES IN FOOD STORES - 1965	SM T
1334	% TOTAL RETAIL SALES IN EATING AND DRINKING PLACES - 1965	SM T
1335	% TOTAL RETAIL SALES IN GENERAL MERCHANDISE - 1965	SM T
1336	% TOTAL RETAIL SALES IN APPAREL - 1965	SM T
1337	% TOTAL RETAIL SALES IN FURNITURE - 1965	SM T
1338	% TOTAL RETAIL SALES IN AUTOMOTIVE - 1965	SM T
1339	% TOTAL RETAIL SALES IN GASOLINE - 1965	SM T
1340	% TOTAL RETAIL SALES IN LUMBER, BUILDING MATERIALS, HARDWR - 1965	SM T
2001	% TOTAL RETAIL SALES IN DRUG STORES - 1965	SM T

MANUFACTURING

1282	TOTAL MANUFACTURING ESTABLISHMENTS - 1958	CCDR S
1283	TOTAL EMPLOYED, MANUFACTURING ESTABLISHMENTS - 1958	CCDR S
1284	TOTAL PAYROLL, MANUFACTURING ESTABLISHMENTS - 1958	CCDR S
1311	% PRODUCTION WORKERS OF ALL MANUFACTURING EMPLOYEES - 1958	CCDR T

1312 % PRODUCTION PAYROLL OF ALL MANUFACTURING PAYROLL - 1958	CCDR	T
290 MANUFACTURING NEW CAPITAL EXPENDITURES - 1958	CCDR	S
285 ADJUSTED DOLLAR VALUE ADDED BY MANUFACTURING - 1958	CCDR	S
3264 PERCENTILE, VALUE ADDED BY MANUFACTURERS - 1959	CCDR	T

MINERAL INDUSTRIES

1286 NUMBER OF ESTABLISHMENTS IN MINERAL INDUSTRIES - 1958	CCDR	S
1287 NUMBER OF EMPLOYEES IN MINERAL INDUSTRIES - 1958	CCDR	S
1288 PAYROLL IN MINERAL INDUSTRIES - 1958	CCDR	S
1289 DOLLAR VALUE, SHIPMENTS AND RECEIPTS FOR MINERAL INDUSTRIES - 1958	CCDR	S
2092 VALUE OF MINERAL SHIPMENTS - 1954	CCDR	S
2091 % CHANGE IN VALUE OF MINERAL SHIPMENTS - 1954-1958	CCDR	T
1313 DOLLAR VALUE, SHIPMENTS AND RECEIPTS IN MIN. IND. PER EMPLO. - 1958	CCDR	T
3266 PERCENTILE, MINERAL INDUSTRIES, VALUE SHIPMENTS, RCPT., 1958	CCDR	T

PERSONAL FINANCE

2002 TOTAL POPULATION - 1966	SM	S
2016 PER CAPITA DISPOSABLE INCOME - 1966	SM	S
3246 PERCENTILE, PER CAPITA DISPOSABLE INCOME - 1966	SM	T
1233 % HOUSEHOLDS \$1-2499 - 1966 - XX	SM	S
1234 % HOUSEHOLDS \$2500-3999 - 1966 - XX	SM	S
1235 % HOUSEHOLDS \$4000-5999 - 1966 - XX	SM	S
1236 % HOUSEHOLDS \$7000-9999 - 1966 - XX	SM	S
1237 % HOUSEHOLDS \$10,000 OR OVER - 1966 - XX	SM	S
2011 MEDIAN INCOME - 1959	CCDR	S
2103 MEDIAN INCOME - 1966	SM	S
3250 PERCENTILE, MEDIAN FAMILY INCOME - 1959	CCDR	T
248 PERCENTILE, MEDIAN HOUSEHOLD INCOME - 1966	SM	T
2101 % NET \$ INCOME IN LESS THAN \$2,500 BRACKET OF TOTAL NET \$	SM	T
3131 % OF HOUSEHOLDS WITH 1966 INCOME, \$1-2499 - XX.X	SM	S
2100 % NET \$ INCOME IN \$10,000 AND OVER BRACKET OF TOTAL NET \$	SM	T
3135 % OF HOUSEHOLDS WITH 1966 INCOME, \$10,000 & ABOVE - XX.X	SM	S
3252 PERCENTILE, NO. HOUSEHOLDS WITH INCOME LESS THAN \$2500 - 1966	SM	T
2005 NUMBER HOUSEHOLDS WITH UP TO \$2,499 ANNUAL INCOME - 1966	SM	T
3254 PERCENTILE, % HOUSEHOLDS WITH INCOME LESS THAN \$2500 - 1966	SM	T

COMMERCIAL FINANCE

2012 BANK DEPOSITS, DEMAND - 1960	CCDR	S
2013 BANK DEPOSITS, TIME - 1960	CCDR	S
2093 BANK DEPOSITS - 1960	CCDR	S
3268 PERCENTILE, BANK DEPOSITS - 1960	CCDR	T
2095 % CHANGE BANK DEPOSITS 1956-1960	CCDR	T
2094 BANK DEPOSITS - 1956	CCDR	S
2096 BANK DEPOSITS - 1950	CCDR	S
2097 % CHANGE BANK DEPOSITS 1950-1960	CCDR	T
2014 SAVINGS CAPITAL, SAVINGS AND LOAN ASSOCIATIONS - 1960	CCDR	S
2015 FIRST TERM MORTGAGES, SAVINGS AND LOAN ASSOCIATIONS - 1960	CCDR	S

GOVERNMENT FINANCE, REVENUES AND EXPENDITURES

2028 TOTAL REVENUE - 1962	CGOV	S
2030 TOTAL EXPENDITURE - 1962	CGOV	S

66	TOTAL REVENUE MINUS EXPENDITURE - 1962	CGOV	T
29	TOTAL REVENUE, PER CAPITA - 1962	CGOV	S
2031	TOTAL EXPENDITURE, PER CAPITA - 1962	CGOV	S
3274	PERCENTILE, TOTAL GOVERNMENT EXPENDITURES PER CAP. - 1962	CGOV	T
2025	LONG TERM DEBT, END OF - 1962	CGOV	S
2067	SHIFT IN LONG TERM DEBT - 1962	CGOV	T
2027	SHORT TERM DEBT, END OF - 1962	CGOV	S
2065	TOTAL DEBT PER CAPITA - 1962	CGOV	T
2032	% REVENUE FROM PROPERTY TAX - 1962	CGOV	T
2033	% REVENUE FROM UTILITIES TAX - 1962	CGOV	T
2034	% REVENUE FROM SALES AND GROSS RECEIPTS TAX - 1962	CGOV	T
2035	% REVENUE FROM PAYROLL, INCOME TAX - 1962	CGOV	T
2036	% REVENUE FROM STATE GOVERNMENT - 1962	CGOV	T
2038	% REVENUE FROM FEDERAL GOVERNMENT - 1962	CGOV	T
2039	% REVENUE FROM CURRENT CHARGES - 1962	CGOV	T
2040	% REVENUE FROM INVESTMENT EARNINGS - 1962	CGOV	T
2041	% REVENUE FROM OTHER - 1962	CGOV	T
2042	% ALL EDUCATION EXPENDITURES - 1962	CGOV	T
2043	% ALL POLICE EXPENDITURES - 1962	CGOV	T
2044	% ALL EXPENDITURES, FIRE PROTECTION - 1962	CGOV	T
2045	% ALL EXPENDITURES, HIGHWAYS - 1962	CGOV	T
2046	% ALL EXPENDITURES, SEWERAGE - 1962	CGOV	T
2047	% ALL EXPENDITURES, OTHER SANITATION - 1962	CGOV	T
2048	% ALL EXPENDITURES, WELFARE ASSISTANCE - 1962	CGOV	T
2049	% ALL EXPENDITURES, LIBRARIES - 1962	CGOV	T
2050	% ALL EXPENDITURES, OWN HOSPITALS - 1962	CGOV	T
2051	% ALL EXPENDITURES, OTHER HOSPITALS - 1962	CGOV	T
2052	% ALL EXPENDITURES, HEALTH - 1962	CGOV	T
2053	% ALL EXPENDITURES, PARKS AND RECREATION - 1962	CGOV	T
2054	% ALL EXPENDITURES, FINANCIAL ADMINISTRATION - 1962	CGOV	T
2055	% ALL EXPENDITURES, GENERAL CONTROL - 1962	CGOV	T
2056	% ALL EXPENDITURES, AIRPORTS - 1962	CGOV	T
2057	% ALL EXPENDITURES, INTEREST ON GENERAL DEBTS - 1962	CGOV	T
2058	% ALL EXPENDITURES, PORTS AND TERMINALS - 1962	CGOV	T
2059	% ALL EXPENDITURES, HOUSING AND URBAN RENEWAL - 1962	CGOV	T
2060	% ALL EXPENDITURES, GENERAL PUBLIC BUILDINGS - 1962	CGOV	T
2061	% ALL EXPENDITURES, CORRECTION - 1962	CGOV	T
2062	% ALL EXPENDITURES, NATURAL RESOURCES - 1962	CGOV	T
2063	% ALL EXPENDITURES, LIQUOR STORES - 1962	CGOV	T

S O C I A L P R O F I L E

COMMUNITY HEALTH FACILITIES AND MANPOWER

3068	PER CAPITA INCOME - 1962	HMP	T
3100	STATE PER CAPITA INCOME - 1962	HMP	S
3049	NUMBER OF DOCTORS - 1962	HMP	S
3046	TOTAL POPULATION - 1962	HMP	S
3060	NUMBER OF DOCTORS PER 100,000 POPULATION - 1962	HMP	T
3092	NUMBER OF DOCTORS PER 100,000 TOTAL STATE POPULATION - 1962	HMP	S
3107	PERCENTILE, DOCTORS PER 100,000 COUNTY POPULATION	HMP	S
3062	NUMBER OF DENTISTS PER 100,000 POPULATION - 1962	HMP	T
3094	NUMBER OF DENTISTS PER 100,000 TOTAL STATE POPULATION - 1962	HMP	S
3064	NUMBER OF PHARMACISTS PER 100,000 POPULATION - 1962	HMP	T

3096	NUMBER OF PHARMACISTS PER 100,000 TOTAL STATE POP. - 1962	HMP	S
3048	NUMBER OF BEDS IN GENERAL AND ALLIED SPECIAL HOSPITALS - 1962	HMP	S
3059	NUMBER OF HOSPITAL BEDS PER 100,000 POPULATION - 1962	HMP	T
3091	NUMBER OF HOSPITAL BEDS PER THOUSAND TOTAL STATE POPULATION - 1962	HMP	S
3109	PERCENTILE, HOSPITAL BEDS PER 100,000 COUNTY POPULATION	HMP	S
3056	NUMBER OF REGISTERED NURSES - 1962	HMP	S
3070	NURSES PER HOSPITAL BED - 1962	HMP	T
3102	STATE NURSES PER HOSPITAL BED - 1962	HMP	T
3065	NUMBER OF SANITARY ENGINEERS PER 100,000 POPULATION - 1962	HMP	T

HOUSING

2271	% UNITS SOUND WITH ALL PLUMBING FACILITIES - 1960	CCDB	S
2311	% DWELLING UNITS NOT DILAPIDATED - 1950	CCDB	S
2274	% UNITS WITH 1.01 OR MORE PERSONS/ROOM - 1960	CCDB	S
2273	POPULATION PER HOUSING UNITS - 1960	CCDB	S
2313	MEDIAN NUMBER OF PERSONS/UNIT - 1950	CCDB	S
2270	% UNITS BUILT IN 1950 OR LATER	CCDB	S
2283	% OCCUPIED UNITS WITH WASHING MACHINE - 1960	CCDB	S
2284	% OCCUPIED UNITS WITH FOOD FREEZER - 1960	CCDB	S
2285	% OCCUPIED UNITS WITH AIR CONDITIONING - 1960	CCDB	S
2286	% OCCUPIED UNITS WITH TELEVISION SET - 1960	CCDB	S
2287	% OCCUPIED UNITS WITH TELEPHONE - 1960	CCDB	S
2288	% OCCUPIED UNITS WITH ONE AUTOMOBILE - 1960	CCDB	S
2289	% OCCUPIED UNITS WITH 2 OR MORE AUTOMOBILES - 1960	CCDB	S
2277	MEDIAN VALUE OWNER-OCCUPIED UNITS - 1960, \$5000 MIN.	CCDB	S
2315	MEDIAN VALUE, OWNER-OCCUPIED 1 UNIT STRUCTURES, 1950	CCDB	S
1109	% CHANGE - MEDIAN VALUE HOMES, 1950 - 1960	CCDB	T
2280	MEDIAN GROSS RENT/MONTH - 1960	CCDB	S
2316	MEDIAN GROSS RENT/MONTH RENTER-OCCUPIED - 1950	CCDB	S

EDUCATION

2258	MEDIAN SCHOOL YRS. COMPLETED BY POP. 25 YRS. OR OVER - 1960	CCDB	S
2306	MEDIAN SCHOOL YRS. COMPLETED BY POPULATION 25 AND OVER - 1950	CCDB	S
2259	% POP. 25 OR OVER COMPLETING LESS THAN 5 YRS. OF SCHOOL - 1960	CCDB	S
2260	% POP. 25 OR OVER COMPLETING HIGH SCHOOL OR MORE - 1960	CCDB	S
3033	PERCENTILE, % 25 YRS. AND OVER COMP. LESS THAN 5 YRS. OF SCH - 1960	CCDB	S
1268	TOTAL EDUCATION EXPENDITURES - 1962	CGOV	S
2042	% ALL EDUCATION EXPENDITURES - 1962	CGOV	T
1269	PER CAPITA EDUCATION EXPENDITURES - 1962	CGOV	S
3025	% INCREASE/DECREASE TOTAL SCHOOL ENROLLMENT - 1960-66	SM	T
2191	TOTAL 1960 ELEM. AND HIGH SCHOOL ENROLLMENTS	CCDB	T
3012	HIGH AND ELEMENTARY SCHOOLS ENROLLMENT - 1965	SM	S

APPENDIX D

GOVERNORS' REPLIES



Office of Planning and Budget

Executive Department

July 14, 1978

Clark T. Stevens
Director

Mr. Wesley Copeland, President
International Science and Technology
Institute
1129 20th Street Northwest
Suite 404
Washington, D. C. 20036

Dear Mr. Copeland:

Governor Busbee referred your correspondence concerning the development of small-dam hydropower for low-income communities to this Office for reply. While some potential may exist for this type of program, I have been unable to secure any definitive information in the short time available.

However, due to this Office's involvement in the Department of Energy's low-head hydro program, I am aware of an existing dam near Juliette, Georgia that may have potential for your purposes. This dam, which is not now used to generate power, is located on the Ocmulgee River, and was formerly owned by the Juliette Milling Company. It had an installed capacity of 1,022 kilowatts, with an average annual generation of 2,000 kilowatt-hours. The Community Action Agency in that area indicates that there is a sizeable low-income community in Juliette.

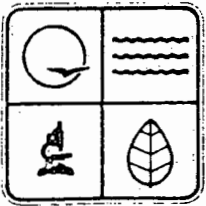
I would appreciate being apprised of your conclusions and recommendations to the Community Services Administration, and if I may be of further assistance please contact me.

Sincerely,

Rob Harvey

Rob Harvey
Office of Energy Resources

RH:cm



MISSOURI DEPARTMENT OF NATURAL RESOURCES

P.O. Box 176 Jefferson City, Missouri 65101 (314) 751-3195

June 28, 1978

Mr. B. K. Wesley Copeland
International Science and Technology Institute
1129 20 St. Northwest, Suite 404
Washington, D.C. 20036

Dear Mr. Copeland:

Within the time limits which you have set, we have been able to identify several small dams and sites which seem to meet your criteria. The attached list contains several mills which might be feasibly altered for hydropower generation.

Our information to you is limited for several reasons. First, a specific operational definition of the key variables (e.g. "small dams" and "low income") was not available. Second, the criteria for generating capability was assumed by us to be continuous generation rather than emergency power supply. This factor limited the dams and sites we considered for inclusion. Third, our Division of Geology and Land Survey is just starting (with the Army Corps of Engineers) a survey that will inventory Missouri dams of significant size. Until the survey is finished, we are not in a position to provide complete, accurate information. Fourth, there are over 3,000 dams in Missouri. This prevents a quick determination of the hydropower capacity of dams and sites within our state.

Upon completion of the dam inventory, we will be pleased to work with your researchers here in Missouri to develop the data you require.

Sincerely,

DEPARTMENT OF NATURAL RESOURCES

Robert S. Townsend
Acting Director

RST:jda

Attachment

Division of Policy Development
Robert Townsend Director

Joseph P. Teasdale Governor
Carolyn Ashford Director

<u>SITE</u>	<u>COUNTY</u>	<u>SOURCE</u>
Aid-Hodgson	Ozark	spring
Dawt Mill	Ozark	North Fork River
Alley Spring	Shannon	Alley Spring
Falling Spring	Oregon	spring
Rockbridge Mill	Ozark	spring & stream
Dolle Mill	Bollinger	spring
Topaz Mill	Douglas	Topas Spring
Dillard Mill	Crawford (Dillard)	Huzzah
Dry Knob Mill	Laclede	Osage Fork
Appleton Mill	Cape Girardeau	Apple Creek
Montauk Mill	Dent	springs & stream
Robinson Mill	Iron	tributary of Black River
Bollinger Mill	Cape Girardeau	White Water River
Orla Mill	Laclede	tributary of Osage River
Mill Spring	Carter	Mill Spring

THE STATE



OF WYOMING

ED HERSCHLER
GOVERNOR

State Engineer's Office

BARRETT BUILDING

CHEYENNE, WYOMING 82002

WYOMING WATER PLANNING PROGRAM

July 6, 1978

B.K. Wesley Copeland, President
International Science and Technology
Institute
1129 20th Street Northwest, Suite 404
Washington, D.C. 20036

Dear Mr. Copeland:

I am responding to your request for information on hydropower generation at existing dams where low income communities are close by. I am attaching some information that was provided to Mr. Thelen, Corps of Engineers, Omaha District.

The following is a list of the dams and the associated low income communities.

<u>Dam</u>	<u>Low income Community</u>	<u>Population</u>
Jackson Lake Dam	Afton	1290
	Thayne	195
Willwood Dam	Would serve two small local Rural Electric Associations	
Pilot Butte Power Plant	Pavillion	181
Bull Lake Dam	Fort Washakie	300
Wind River Diversion Dam	Ethete	50
	Wind River Indian Reservation	
Keyhole Reservoir	Sundance	1056
	Hulett	318

Keyhole Dam and Reservoir uses not included in the information sent to the Corps of Engineers; however, Sundance and Hulett are two lower income towns in Wyoming.

Other small scale hydropower generation potential exists in Wyoming and much of it is associated with the large irrigation districts and their water

7/10

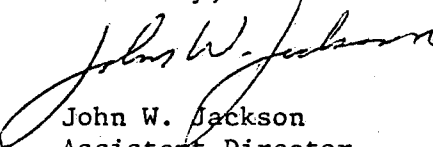
July 6, 1978
B.K. Wesley Copeland, President

Page 2

delivery systems. No in depth analysis of these potentials has been done by the State; however, a local engineering firm, Tudor Engineering, mentioned in the attached information has done some investigation of this potential.

If additional information is desired on these dams, please feel free to contact us.

Sincerely,



John W. Jackson
Assistant Director

JWJ/vsb
Enclosure
cc: George L. Christopulos



STATE OF
WASHINGTON

Dixy Lee Ray
Governor

OFFICE OF THE GOVERNOR

Legislative Building, Olympia, Washington 98504

July 7, 1978

Mr. B. K. Wesley Copeland, President
International Science and Technology
Institute
1129 - 29th St. S.W., Suite 404
Washington, D.C. 20036

Dear Mr. Copeland:

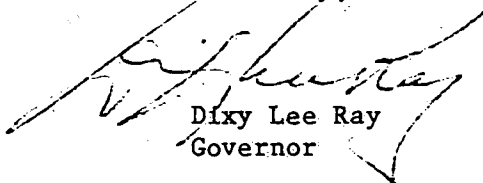
You requested by mailgram, June 27, 1978, comments and a list of small dams, size and location, and number and location of nearby low-income communities which would benefit from the potential hydroelectric generating facilities.

We have assembled in the enclosed table a list of low-income communities with dams and/or reservoirs located nearby. Some approximate data is included in the table to assist in your assessment, such as head and discharge.

Should your proposed program be funded, a more comprehensive and detailed assessment of these and other such potential opportunities in Washington State could be provided.

I hope this information will assist you in your evaluation.

Sincerely,



Dixy Lee Ray
Governor

Enclosure

Dam and Reservoir	Capacity (Ac.-Ft.)	Location (Stream)	Average Flow (cfs)	Head (ft.)	Nearby Low Income Community	Location (County)	Town Population (Number)	Unemployment (County, Percent)
Enloe Dam	2,400	Similkaneeh River	2,300	60	Oroville	Okanogan	1,565	11.6
Lake CleElum	710,000	CleElum River	934	124	Roslyn	Kittitas	1,015	10.1
Easton Diversion Dam	4,000	Yakima R.	1,066	56	CleElum	Kittitas	1,725	10.1
Granite Creek (Republic Water Supply)	- -	Granite Creek	20	30	Republic	Ferry	1,053	9.2
Wynoochee Dam	70,000	Wynoochee River	1,260	162	Aberdeen	Grays Harbor	18,900	6.0
					Cosmopolis	Grays Harbor	1,590	6.0
					Montesano	Grays Harbor	2,790	6.0

DEPARTMENT OF WATER RESOURCES

P. O. BOX 388
SACRAMENTO
95802



(916) 445-9248

JUL 17 1973

Mr. B. K. Wesley Copeland
President
International Science and Technology
Institute
1129 - 20th Street N. W., Suite 404
Washington, DC 20036

Dear Mr. Copeland:

Your Mailgram of June 25, 1978, requesting information on California's hydroelectric potential at existing small dams to Governor Brown was referred to me for response.

Enclosed is a summary of the requested information which was obtained from our Preliminary Office Report on our small hydroelectric site survey conducted in 1976.

We are preparing a bulletin that will report the results of our survey, but it will not be available until later this year. I hope the enclosed information will be helpful to you. For further information, please call Mr. Richard Ferreira, Chief of Energy Systems Branch, Energy Division at (916) 322-3802.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Ronald B. Robie'.

Ronald B. Robie
Director

Enclosure

cc: Honorable Edmund G. Brown Jr.
Governor of California

S M A L L E X I S T I N G D A M S
WITH HYDROELECTRIC POTENTIAL

Dam Name	Owner	MW	GWh	County	Township, Range (Base)
Antelope Dam	Cal. Dept. of Water Resources	1	3	Plumas	27N, 12E (MD)
Box Canyon Dam	Siskiyou Co. F.C. & W.C.D.	4	20	Siskiyou	40N, 4W (MD)
Camanche Dam	East Bay M.U.D.	6	25	San Joaquin	4N, 9E (MD)
Camp Far West Dam	South Sutter W.D.	3	17	Placer	14N, 6E (MD)
Concow Dam	Thermalito I.D.	*	*	Butte	22N, 4E (MD)
Frenchman Dam	Cal. Dept. of Water Resources	2	3	Plumas	24N, 16E (MD)
Grizzly Valley Dam	Cal. Dept. of Water Resources	2	3	Plumas	23N, 13E (MD)
Little Grass Valley Dam	Oroville-Wyandotte I. D.	14	70	Plumas	22N, 9E (MD)
Nacimiento Dam	Monterey Co. F.C. & W.C.D.	4	20	San Luis Obispo	25S, 10E (MD)
Pyramid Stream Release	Cal. Dept. of Water Resources	2	4	Los Angeles	6N, 18W (SB)
Robert W. Matthews	Humbolt Bay M.W.D.	3	6	Trinity	1S, 7E (H)
San Antonio Dam	Monterey Co. F.C. & W.C.D.	2	3	Monterey	24S, 10E (MD)
Santa Felicia Dam	United W.C.D.	1	3	Ventura	4N, 18W (SB)
Shasta River Dam No. 60	Montague W.C.D.	0.2	**	Siskiyou	43N, 5W (MD)
Sly Creek Dam	Oroville-Wyandotte I.D.	10	45	Butte	20N, 8E (MD)
Virginia Ranch Dam	Browns Valley I.D.	0.5	3	Yuba	17N, 6E (MD)

* Insufficient data received ** Under one million kWh

Co. F.C. & W.C.D. - County Flood Control & Water Conservation District
I.D. - Irrigation District
M.U.D. - Municipal Utility District
M.W.D. - Municipal Water District
W.C.D. - Water Conservation District

Energy Division
Department of Water Resources
July 10, 1978

STATE OF ALASKA

JAY S. HAMMOND
GOVERNOR

**DEPARTMENT OF COMMERCE &
ECONOMIC DEVELOPMENT**
DIVISION OF ENERGY & POWER DEVELOPMENT

7TH FLOOR MACKAY BLDG
338 DENALI STREET
ANCHORAGE, AK. 99501
Tel. (907) 272-0527

July 24, 1978

Ms. Mary Allen
International Science & Technology Institute
1129 20th Street, N.W.
Suite 404
Washington, D. C. 20036

Dear Ms. Allen:

This will confirm our telephone conversation of July 14 pertinent to your telegraphic inquiry received by this office June 30 regarding small dams in proximity to low income communities.

Some 175 sites have been identified in the State that would possibly fall within your .5 to 15 megawatt small hydro classification. Of these, some 75 were at one time licensed by the Federal Power Commission. I would guess that perhaps 50 to 60 of these 175 sites could be considered potential projects under your program depending somewhat on your definition of "low income community" and incentives that might improve marginal feasibility.

The following listed projects identified by city, project and size are simply those that have been looked at most recently, fall within the criterion you have set down and appear feasible even without Federal participation.

1.	Angeon	Thayer Creek	1 MW
2.	Craig, Hydaburg & Klawack	Black Bear Lake	5 MW
3.	Cordova	Power Creek	5 MW
4.	Dillingham	Lake Elva	2.25 MW
5.	Haines, Klukwan	Chilkoot River	8 MW
6.	Hoonah	Gartina Creek	.75 MW
7.	Kake	Gunnuk Creek	1.8 MW
8.	Ketchikan	Swan Lake	15 MW
9.	Kodiak	Terror Lake	12 MW
10.	Pelican	Pelican Creek Addition	.5 MW
11.	Petersburg	Crystal Lake Expansion	3.5 MW
		Dam Water Supply Reservoir	1 MW (estimated)
12.	Sitka	Green Lake	15 MW
13.	Teller	Bluestone Canyon	3 MW
14.	Wrangell	Virginia Lake	12 MW

Miss Mary Allen

-2-

July 24, 1978

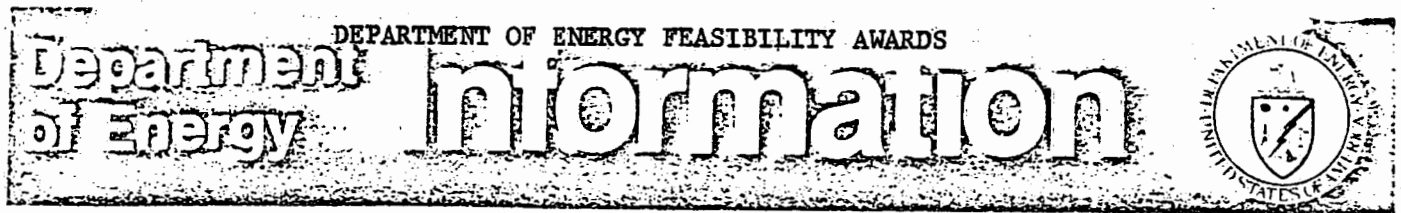
We hope this information is helpful and would appreciate being kept informed of any Federal participation or any other information pertinent to hydro projects of this size. We feel that small hydroelectric development has great potential in many parts of Alaska.

Sincerely,

A handwritten signature in dark ink, reading "Dale W. Rusnell". The signature is written in a cursive, slightly slanted style.

Dale W. Rusnell
Chief, Power Development

cc: Clarissa Quinlan
Honorable Ted Stevens
Honorable Mike Gravel
Honorable Donald E. Young



Office of Public Affairs
Washington, D.C. 20461

FOR IMMEDIATE RELEASE
April 26, 1978

SMALL DAMS TO BE STUDIED
AS POTENTIAL POWER SOURCES

A first step has been taken to revive one of the Nation's oldest and often neglected energy resources -- the hydroelectric power of small rivers and streams.

Fifty-seven proposals to evaluate existing dams in 30 states and Puerto Rico have been selected by the Department of Energy (DOE) for negotiating contracts. Under terms of the contracts, studies will be conducted to determine the feasibility of installing hydroelectric generators at dams less than 65 feet high.

Such dams, already in existence but essentially unused or abandoned, have a nationwide potential for adding up to 54 million kilowatts of electrical generating capacity to the U.S. energy supply. The total power potential from both existing dams and undeveloped small-dam sites capable of generating 5,000 kilowatts or less is estimated at 200 million kilowatts, roughly 40 percent of the Nation's current electricity supply.

The Government portion of the contracts is expected to total about \$2.9 million and would be funded over the next six months. Approximately the same amount of funding will be expended by the contractors. Each of the firms will evaluate enlargement, rehabilitation or construction of hydropower facilities.

The 57 projects were selected from 224 proposals submitted in response to a DOE solicitation last December. The assessments are part of a planned series of proposal solicitations expected to result in cost-sharing demonstration projects across the country. DOE has allocated \$10 million for the current fiscal year for programs on research, development and demonstration of small-dam hydroelectric power.

MORE

R-78-151

The 57 projects for which contracts will be negotiated are in:

Alaska
California
Connecticut
Florida
Georgia
Idaho
Illinois
Indiana
Kansas
Massachusetts

Maryland
Maine
Michigan ✓
Minnesota
Mississippi
Montana
Nebraska
New Hampshire
New York
Ohio
Oklahoma

Oregon
Pennsylvania
Rhode Island
Texas
Virginia
Vermont
Washington
Wisconsin
Wyoming
Puerto Rico

-DOE-

(NOTE TO EDITORS: A list of the selected proposers and their sites is attached.)

NEWS MEDIA CONTACTS: William L.R. Rice, 202/376-9471
Andrea G. Davey, 202/566-9833

R-78-151

SUCCESSFUL PROPOSERS

Proposers

City of Seward
P.O. Box 337
Seward, Alaska 99664

City of Siloam Springs
Siloam Springs, Arkansas

Energy Research and Appli-
cations, Inc.
1301 E. El Segundo Blvd.
El Segundo, California 90245

Modesto Irrigation District
P.O. Box 4060
Modesto, California 95352

City of Redding
760 Parkview Avenue
Redding, California 96001

Turlock Irrigation District
P.O. Box 949
Turlock, California 95380

Town of Canton
4 Market Street
Collinsville, Connecticut 06022

City of Tallahassee
Atten: J.B. Dykes, Jr.
City Hall
Tallahassee, Florida 32301

State of Georgia
Office of Energy Resources
270 Washington Street SW, Rm 615
Atlanta, Georgia 30334

Boise Project Board of Control
Atten: Royse Van Curen
214 Broadway
Boise, Idaho 83701

Dam Sites

Seward

Lake Francis, Oklahoma

Patillas, Puerto Rico

Central (near Modesto)

Red Bluff

San Joaquin Valley
(near Modesto)

Canton

Tallahassee (20 Miles
Southwest)

Monroe

Boise

City of Carlyle
c/o City Hall
850 Franklin
Carlyle, Illinois 62231

Carlyle

Hotel Baker Lutheran Welfare
Services of Illinois
4840 W. Bryan Street
Chicago, Illinois 60641

St. Charles

Kansas Electric Power Coop., Inc.
P.O. Box 4267
Gage Center Station
Topeka, Kansas 56604

Manhattan

Raytheon Service Company
Spencer Laboratory
2 Wayside Road
Burlington, Massachusetts 01803

Chicopee
Lowell

City of Northampton
c/o Planning Department
Atten: Nancy Stack
Municipal Office Building
Northampton, Massachusetts 01060

Northhampton

Foster-Miller Assoc., Inc.
135 Second Avenue
Waltham, Massachusetts 02154

Kennebunk, Maine

Town of Wareham
Town Hall
Wareham, Massachusetts 02571

Wareham

Booz, Allen & Hamilton, Inc.
Booz, Allen Applied Research Div.
4330 East West Highway
Bethesda, Maryland 20014

Goffstown, New Hampshire

Brighton Dam Feasibility Study
Atten: A.L. Will, Project Mgr.
Washington Suburban Sanitary Committee
2017 Hamilton Street
Hyattsville, Maryland 20781

Brighton

Central Maine Power Company
Tippetts-Abbott-McCarthy-Stratton
Edison Drive
Augusta, Maine 04336

Saco

Central Maine Power Company
Kleinschmidt & Dutting
Edison Drive
Augusta, Maine 04336

Lewiston, Maine

Central Main Power/Stone-Webster
Engineering Corp.
Edison Drive
Augusta, Maine 04336

Fairfield

✓ Ayres, Lewis, Norris & May, Inc.
The Peninsular Paper Company
3983 Research Park Drive
Ann Arbor, Michigan 48104

Ypsilanti

✓ Ayres, Lewis, Norris & May, Inc.
Van Buren Township, Michigan
3983 Research Park Drive
Ann Arbor, Michigan 48104

Van Buren Township

✓ City of Traverse City
and Grand Traverse
County Joint Venture
Department of Light and Power
City Hall
Traverse City, Michigan 49684

Traverse City

Rochester Public Utility Department
506 First Avenue, NE
Rochester, Minnesota 55901

Rochester

Pat Harrison Waterway District
P.O. Drawer 1509
Hattiesburg, Mississippi 39401

Clark County

Department of Natural Resources &
Conservation
Attn: Richard Bondy
State of Montana
32 South Ewing
Helena, Montana 59601

Tostan

The Central Nebraska Public Power
and Irrigation District
P.O. Box 356
Holdrege, Nebraska 68949

Elwood

Nebraska Municipal Power Pool
Atten: H.S. Wacker, General Manager
521 South 14th St.
Lincoln, Nebraska 68508

Lincoln

Bethlehem Mink Farm
Box 348
Littleton, New Hampshire 03561

Hoyle, Tanner & Assoc., Inc.
One Technology Park
Londonderry, New Hampshire 03053

New York Energy Research and
Development Authority
230 Park Avenue
New York, NY 10017

American Electric Power Service
Corporation
Agent for Michigan Power Company
Indiana & Michigan Electric Co.
2 Broadway
New York, NY 10004

Little Falls Feasibility Study -
Joint Venture
Atten: D.R. Bristol, Project Mgr.
Niagara Mohawk Power Corporation
300 Erie Blvd. West
Syracuse, NY 13202

City of Columbus
Department of Public Services
50 West Broad Street
Columbus, Ohio 43215

City of Piqua, Ohio, Inc.
219 West Water Street
Piqua, Ohio 45356

Confederated Tribes of the Warm
Springs Indian Reservation
Warm Springs, Oregon 97761

Allegheny Electric Cooperative, Inc.
212 Locust Street
Harrisburg, Pennsylvania 17101

Rhode Island State Energy Office
University of Rhode Island
80 Dean Street
Providence, Rhode Island 02903

Bethlehem

Northumberland (2 Proposals)
Concord

Guilderland
Croton Falls (4 Proposals)
High Falls
Lake Placid

Berrien Springs, MI
Buchanan, MI
Elkhart, IN

Little Falls

Columbus

Piqua

Salem

30 miles south of
Pittsburg

Woonsocket

City of Sequin
Utilities Department
P.O. Box 591
Sequin, Texas 78155

Sequin

State of Utah
Division of Water Resources
State Capital Building, Rm. 435
Salt Lake City, UT 84114

Bear River, Wyoming

Dan River Incorporated
Atten.: S.J. Jordan
Director of Corporate Engineers
2291 Memorial Drive
Danville, Virginia 24541

Danville

West River Basin Energy Comm. Inc.
R.D. #1
Jamaica, Vermont 05343

Jamaica

Vermont Electric Cooperative, Inc.
Atten: W.N. Cook, Exec. Mgr.
School Street
Johnson, Vermont 05656

North Hartland

Vermont Marble Company/International
Engineering Company
61 Main Street
Proctor, Vermont 05765

West Central

Central Vermont Public Service
Corp. and Townscape, Inc.
77 Grove Street
Rutland, Vermont 05701

Middlebury

Public Utility District #1 of
Okanogan County
P.O. Box 912
Okanogan, Washington 98840

Oroville

South Columbia Basin
Irrigation District
Atten: Russell D. Smith
Third & West Lewis Street
Pasco, Washington 99301

Coulee City

Spokane City Water Division
East 914 Grace Avenue
Spokane, Washington 99207

Spokane

Kimberly-Clark Corp.
401 North Lake Street
Neenah, Wisconsin 54956

Appleton

APPENDIX F

PARTIAL LIST OF GROUPS TO ASSIST IN ASSESSING ENVIRONMENTAL IMPACT

- ° National Wildlife Federation
- ° American Rivers Conservation Council
- ° National Audubon Society and state societies
- ° American Fisheries Society
- ° Sport Fishing Institute
- ° Trout Unlimited
- ° National Watershed Congress
- ° Citizens Committee on National Resources
- ° The Conservation Foundation
- ° Environmental Policy Center
- ° Sierra Club
- ° International Association of Fish and Wildlife Agencies
- ° Conservation Society of Southern Vermont
- ° New Hampshire Environmental Coalition
- ° Total Environmental Action Foundation
- ° U.S. Fish and Wildlife Service
- ° State fish and wildlife agencies
- ° State water resources boards
- ° Federal Energy Regulatory Commission
- ° Institute for Water Resources, U.S. Army Corps of Engineers

Source: The Johns Hopkins University, Applied Physics Laboratory,
Problems in Redevelopment of Old Hydroelectric Power Dams;
Second Report on New England (Laurel, Maryland: The Johns
Hopkins University, February 1978), p. 28.

APPENDIX G

FEDERAL ENERGY REGULATORY COMMISSION "SHORT FORM"

[6740-02]

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[18 CFR Parts 2, 3, 4, 131]

[Docket No. RM78-9]

**SHORT-FORM LICENSE AND ASSOCIATED
STANDARDIZED CONDITIONS (L-FORM)**

APRIL 21, 1978.

AGENCY: Federal Energy Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The Commission gives notice that it proposes to amend its rules and regulations in order to establish a short-form hydroelectric license with related standard conditions (L-Forms). In addition, a new application form would be established with accompanying instructions for completing the application for a short form license. The purpose of the proposed rulemaking is to provide a simplified procedure and format for processing applications for small-scale hydroelectric projects that meet specific size criteria. Availability of such procedures would save time for the applicant and the Commission staff. It would encourage the development of small capacity hydroelectric projects in furtherance of national policies for conservation of fossil fuels.

DATES: Comments should be submitted not later than May 23, 1978.

ADDRESSES: Secretary, Federal Energy Regulatory Commission, Washington, D.C. 20426.

**FOR FURTHER INFORMATION
CONTACT:**

Ronald Corso, Office of Electric Power Regulation, 202-275-4863;
Raymond Hagenlock, Office of the General Counsel, 202-275-4271.

SUPPLEMENTARY INFORMATION:
Pursuant to section 553, Title 5,

SOURCE: Federal Register, Vol. 43, No. 83 (April 28, 1978), pp. 18196-18205

United States Code, and sections 4(e), 9, 10, and 309 of the Federal Power Act (Act) (41 Stat. 1065-1066, 1068-1069, 49 Stat. 840-841, 858-859, 61 Stat. 501; 16 U.S.C. 797(e), 802, 803, and 825h), and sections 402 and 403 of the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565), the Commission gives notice that it proposes to amend specific sections of the rules and regulations in order to establish a short-form hydroelectric license with related standard conditions (L-Forms). In addition, a new application form would be established with accompanying instruction for completing the application for a short-form license.

The purpose of this proposed rule-making is to provide a simplified procedure and format for processing applications for small-scale hydroelectric projects that meet specific size criteria as stated herein. Availability of such procedures would save time for the applicant and the Commission staff. It would encourage the development of small capacity hydroelectric projects in furtherance of national policies for conservation of fossil fuels. For example, considerable impetus and increased attention is being given to hydroelectric projects as a result of the Administration's energy policies (such as the incentive program for projects less than 15 megawatts included in the National Energy Act proposals now under consideration by a Joint Conference Committee of the U.S. Senate and House of Representatives).

There has been a sharp increase in the number of inquiries and applications received by Commission staff in recent months concerning the installation of additional generating capacity at existing hydroelectric projects, the redevelopment of existing projects to provide additional power, and the installation of power generating facilities at existing nonpower dams. Indications are that this interest will result in sharply increased numbers of applications being filed with the Commission in the future.

Constraints imposed by the Federal Power Act inhibit to some extent the ability of the Commission to expedite action on applications. However, with regard to projects of 2,000 horsepower or less, the Commission has availed itself in the past of the authority provided in section 10(i) of the Act, 16 U.S.C. 803(i), to "waive such conditions, provisions, and requirements" of part I of the act as may be deemed in the public interest to waive under the circumstances. The only exclusions to this waiver provision in section 10(i) are the granting of license periods longer than 50 years and changes in the requirements for annual charges for use of lands within Indian reservations.

In an effort to reduce the burden of application preparation for small pro-

jects, the Commission's regulations currently require considerably less detail in applications for projects of 2,000 horsepower or less (approximately 1,500 kilowatts) than for larger projects. Section 4.60 of the regulations requires use of the format prescribed by section 131.6 of the regulations for such projects.

However, utilization of the provisions of § 131.6 does not always result in the expected savings of time and effort in the processing of applications. This is generally due to the quality of the application initially received (i.e., the extent to which the application conforms to the requirements of the regulations). Experience shows that applicants are often unable to obtain (or understand) the regulations. Staff analysis shows that potential time savings are also often unrealized for other reasons such as delays in receipt of comments from affected Federal, State, and local agencies with respect to the application, low priority of small projects versus those producing substantial blocks of new generating capacity, occasional protests or interventions, etc. The overall result is that a minor project application with no complex features routinely requires from 6 to 9 months to be processed for Commission consideration for licensing. The Commission by this rulemaking seeks to simplify the licensing process for small hydroelectric projects.

To reduce the time required to process applications for licenses for small projects, a "short-form" application and license is proposed. In brief, the intention is to develop a simple application format which could be completed by an applicant following instructions furnished with the form, attaching only the minimum drawings, certifications, etc., necessary to meet the requirements of the Federal Power Act and other applicable statutes. Compared to the present regulations, the proposed short-form application would lessen the descriptive information needed, reduce the details required on maps and drawings, and simplify the requirements for complying with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq., without compromising environmental considerations.

To provide for the broadest applicability of the proposed procedure to the Commission's workload, and to ensure compliance with applicable statutes, it would be necessary to impose certain limitations on utilization of the proposed procedure. The "Short-form" procedures would not be used on any projects:

- (1) Having a dam or diversion structure more than twenty-five (25) feet in height above stream bed,
- (2) Impounding a reservoir having a surface area of 10 acres or more,
- (3) Exceeding 2,000 horsepower (1,500 kilowatts).

The first criterion was chosen because it is consistent with the National Dam Inspection Act, 33 U.S.C. 467a-467e, that is, dams of this size would likely be in a low hazard category. The second criterion was chosen because it is consistent with the Fish and Wildlife Coordination Act, 16 U.S.C. 661-666c, that is, formal consultation with the Federal and State fish and wildlife agencies is not required when the maximum surface area of the impoundment is less than 10 acres. And the third criterion was chosen based upon section 10(i) of the Federal Power Act as explained above.

There would be no limitation on the status of the applicant, i.e., it may be an individual, an association, a State, a municipality, a corporation, or other entity. Appropriate identification of the applicant's status would be required.

If the project were proposed for development on Federal lands, the applicant would be required to apply for any appropriate permits required by the agency having jurisdiction over the Federal lands involved.

Applicants for proposed projects would be required to consult with appropriate Federal, State, and local resources agencies during the preparation of the applications and provide interested agencies with the opportunity to comment on the proposal prior to its filing with the Commission. The comments of such agencies would be attached to the application when filed.

When the application is found to be in conformance with the regulations and acceptable for processing, a public notice would be issued by the Commission pursuant to section 1.19(b) of the Commission's regulations and section 4(e) of the Act, 16 U.S.C. 797(e). This notice would afford an opportunity for Federal, State, and local agencies, and the general public, to inform the Commission of objections to the proposed project, or to provide conditions which the agencies believe should be included in any license which may be issued. We emphasize that applications for such projects would not be forwarded to Federal, State, and local agencies for comments. Public notice issued by the Commission would be in sufficient detail to describe the project and its purpose so that agency input in response to public notice could be adequately provided. Copies of the public notice would be individually sent to appropriate agencies in addition to the normal publication in newspapers and in the FEDERAL REGISTER. The expanded public notice would include additional descriptive information and a map. Although the FEDERAL REGISTER notice would not include such a map, it would indicate that a map could be obtained from the Commission or the applicant upon request. Application guidelines also require contacts with

appropriate agencies prior to filing of the application. The Commission believes these procedures comply with section 4(e) of the Federal Power Act and other statutes.

With respect to NEPA and the Commission's regulations related to NEPA, specifically section 2.80 et seq., the Commission's staff would continue to prepare environmental assessments of the proposal during the review and analysis of each application as is done at present. The information submitted by the applicant as provided for in the new application form, together with the comments and analysis received from interested agencies and members of the public, as well as the independent evaluation of the staff, will form the basis for the ultimate determination of whether an individual proposal will or will not be a major Federal action significantly affecting the quality of the human environment.

The license order would become final 30 days from the date of issuance unless an application for rehearing were filed in accordance with section 313(a) of the Act, 16 U.S.C. 8251(a). Failure to file such an application would constitute acceptance of the license. Acknowledgement of acceptance of the license would be required to be provided to the Commission within 60 days of the date of issuance of the order.

The proposed amendment to the Commission's rules and regulations

under the Federal Power Act would be issued under the authority granted the Federal Energy Regulatory Commission by the Federal Power Act, as amended, particularly sections 4(e), 9, 10, and 309 (41 Stat. 1065-1066, 1068-1069, 49 Stat. 840-841, 858-859, 61 Stat. 501; 16 U.S.C. 797(e), 802, 803, and 825h), sections 402 and 403 of the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565) and E.O. 12009, 42 FR 46267.

PART 3—ORGANIZATION; OPERATION; INFORMATION AND REQUESTS

In order to implement the subject matter considered above, the Commission proposes to amend Part 3, Subchapter A—General Rules, Chapter I, Title 18, Code of Federal Regulations, by deleting the word "major" from §3.114(b). As amended, §3.114(b) will read:

§3.114 Licenses.

(b) Applications under the Federal Power Act for license authorizing construction of projects; for license for constructed projects; and for renewal of licenses for projects are processed in the manner stated in §3.133.

PART 4—LICENSES, PERMITS, AND DETERMINATION OF PROJECT COSTS

2. The Commission proposes to amend Part 4, Subchapter B—Regulations Under the Federal Power Act, Chapter I, Title 18, Code of Federal Regulations, by adding a new §4.61 to read as follows:

§4.61 Contents.

(a) Each application for a short-form license for a small-scale hydroelectric project, whether constructed or to be constructed, shall conform to §131.7 of this chapter and shall be filed in accordance with §4.31 of this chapter.

(b) Short-form licenses are restricted to constructed or unconstructed hydroelectric projects which have or will have generating capacity of 2,000 horsepower (1,500 kW) or less, do not include dams or diversion structures over 25 feet in height above stream bed, and do not impound a reservoir having a surface area of 10 acres or more.

PART 131—FORMS

3. The Commission proposes to amend Part 131, Subchapter D—Approved Forms, Federal Power Act, Chapter I, Title 18, Code of Federal Regulations, by adding a new §131.7 to read as follows:

§131.7 Application for short-form license.

(See §4.61 of this chapter.)

APPLICATION FOR SHORT-FORM LICENSE

1. Applicant's full name and address: _____

 _____ (Zip Code)
2. Location of Project:
 State: _____ County: _____
 Nearest Town: _____ Stream: _____
3. Project description and proposed mode of operation (reference to Exhibit K and L, as appropriate): _____

(continue on separate sheet if necessary)

4. Lands of the United States affected (shown on Exhibit K)
- | | (Name) | (Acres) |
|-----|--|-----------|
| a. | National Forest | |
| b. | Indian Reservation | |
| c. | Public Lands under jurisdiction of | |
| d. | Other | |
| e. | Total U.S. Lands | |
| f. | Check appropriate box: | |
| | / / Surveyed / / Unsurveyed land in public-land state : | |
| (1) | If surveyed land in public-land state provide the following: | |
| | Sections and subdivisions: | |
| | Range | Township: |
| | Principal base and meridian: | |
| (2) | If unsurveyed or not in public-land state, see Item 7 of instructions: | |
| | Purpose of project (use of power output, etc.) | |

6. Construction of the project is planned to start _____
It will be completed within _____ months from the date of
issuance of license.
7. List here and attach copies of State water permits or
other permits obtained authorizing the use or diversion
of water, or the construction, and/or operation and
maintenance of the proposed projects:
8. Attach an environmental report prepared in accordance with
the requirements set forth in the Instructions for
Completing Application for Short-Form License.
9. Attach Exhibit K and L drawings.
10. State of _____ ss:
County of _____ and _____, being
duly sworn, each for himself, deposes and says that
*(he is a citizen of the United States of America), *(all
members of the association are citizens and have signed
this affidavit) or *(he is the duly appointed agent of
the association, municipality or corporation), and has
signed this application this _____ day of _____,
19 _____.

(Applicant(s))

Subscribed and sworn to before me, a Notary Public of the State of _____, this ____ day of _____, 19____.

/SEAL/

(Notary Public)

INSTRUCTIONS FOR COMPLETING APPLICATION
FOR SHORT-FORM LICENSE

GENERAL

1. This application may be used if the proposed project will have a total generating capacity of not more than 1,500 kW, impound a reservoir having a surface area of not more than 10 acres, and include no dam or diversion structure over 25 feet in height. Advice regarding the proper procedure for filing should be requested from the Commission in Washington, D.C.; or from one of the Commission's regional offices in Atlanta, Chicago, Fort Worth, New York, or San Francisco.

2. This application is to be completed and filed in an original and nine copies with the Federal Energy Regulatory Commission, 825 North Capitol Street NE., Washington, D.C. 20426. Each copy of the application is to be accompanied by:

(a) A copy each of exhibits K and L described herein.

(b) A copy of a State water quality certificate pursuant to section 401 of the Federal Water Pollution Control Act, and a water rights certificate or similar evidence required by State law relative to use or diversion of water.

(c) Applicant should contact the State natural resources department or equivalent to ascertain whether other approvals are necessary and attach copies of such approvals to the application.

(d) A copy of applicant's environmental report described herein.

3. No work may be started on the project until receipt of a signed license from the Commission. The application itself does not authorize entry upon government lands for

any purpose. If the project is located in part or in whole upon Federal land, the applicant should contact the appropriate land management agency regarding the need to obtain a right-of-way permit. As noted above, other State or Federal permits may be required.

4. Applicants must be citizens of the United States. If the applicant is a corporation, the State in which it is incorporated and the location of the principal place of business must be shown. If applicant is an association, each member must be a citizen and must sign the affidavit. The affidavit may be attached as a separate sheet if necessary. Corporations (municipal or private), municipalities, and associations of citizens shall provide the name and address of the person who is authorized to act as agent, and consent to accept service upon such agent as service upon the applicant. This information can be provided by a letter attached to the application.

5. If the stream is unnamed, give the name of the nearest named stream to which it is tributary.

6. The project description (application item 4) shall include, as appropriate: The number of generating units, including auxiliary units; the capacity of each unit, and provisions, if any, for future units; type of hydraulic turbine(s); a description of how the plant is to be operated, manual or automatic, and whether the plant is to be used for peaking; estimated average annual generation in kilowatt-hours; estimated average head on the plant; reservoir surface area in acres; estimated hydraulic capacity of the plant (flow through the plant) in cubic feet per second; estimated average flow of the stream at the plant or point of diversion; sizes, capacities, and construction materials,

as appropriate, of pipelines, ditches, flumes, canals, intake facilities, powerhouse, dams, transmission lines, etc.; and estimated cost of project.

7. In the case of unsurveyed public land, or land not in a public-lands State, give the best legal description available. Include distance and general direction from nearest city or town, fixed monument, physical features, etc.

8. Exhibits K and L shall be submitted on separate drawings. Drawings for exhibits K and L shall have identifying title blocks and bear the following certification: "This drawing is a part of the application for license made by the undersigned this — day of —, 19—."

(Name of applicant.)

9. The Commission reserves the right to require additional information, or another filing procedure if data provided indicate such action to be appropriate.

EXHIBIT K—PROJECT LANDS AND BOUNDARIES

1. The exhibit K is a planimetric map showing the portion of the stream developed, the location of all essential project information; such as the dam or diversion structure, pipeline, powerplant, access roads, transmission lines, project boundary, land ownerships, and government land boundaries and identifications.

2. The map shall be an ink drawing or drawing of similar quality on a sheet not smaller than 3 inches by 10½ inches, drawn to a scale no smaller than 1 inch equals 1,000 feet. Ten legible prints shall be submitted with the application. The tracing will be requested after review of the application.

3. The project boundary shall be drawn on the map so that the relationship of each project facility to other property lines can be determined. The boundary shall enclose all project works such as the pipelines, roads, powerhouse, and transmission lines. It shall be the minimum feasible distance from project works necessary to allow operation and maintenance. The distance in feet from each principal facility to the boundary shall be shown. The project boundary should be a surveyed line with stated courses and distances. A tape-compass survey is acceptable. True north shall be indicated on the map. The area of government land in acres within the project boundary shall be shown. It is suggested that the appropriate government agency be contacted for assistance in determining the government land acreage. For clarity, use inset sketches to a larger scale than that used for the overall map to show relationships of project works, natural features, and property lines.

4. Show one or more ties by distance and bearing from a definite, identifiable point or points on project work or the project boundary to established corners of the public land survey or other survey monuments, if available.

5. If the project affects unsurveyed government lands, the protraction of township and section lines shall be shown. Such protractions, whenever available, shall be those recognized by the agency of the United States having jurisdiction over the lands. On unsurveyed lands, show ties by distance and bearing to fixed recognizable objects.

6. If both government and private lands are utilized by the project, the detailed survey descriptions discussed above for the project boundary apply only to government lands. General location data will suffice for project works on private lands.

EXHIBIT L—PROJECT STRUCTURES AND EQUIPMENT

The exhibit shall be a simple ink drawing or drawing of similar quality on a sheet not smaller than 8 inches by 10½ inches, drawn to a scale no smaller than 1 inch equals 50 feet for plans and profiles, and 1 inch equals 10 feet for sections. Ten legible prints shall be submitted with the application. Tracing(s) will be requested after initial review of the application.

2. The drawing shall show a plan, elevation, and section of the diversion structure and powerplant. Generating and auxiliary equipment proposed should be clearly and simply depicted and described. Include a north arrow on the plan view.

ENVIRONMENTAL REPORT

The requirement herein for an environmental report should be consistent with the scope of the project and the environmental impacts of the proposed action, i.e., authorization to operate and maintain an existing project would require less detailed information than authorization to construct a new project. The environmental report shall set forth the following in a clear and concise manner:

(1) A brief description of the project and the mode of operation, i.e., run-of-river, peaking, or other.

(2) A description of the environmental setting in and near the project area to include vegetative cover, fish and wildlife resources, water quality and quantity, land and water uses, recreational use, socioeconomic as-

pects, historical and archeological resources, and visual resources. Special attention shall be provided rare and endangered plant and animal species, critical habitats, sites eligible for or included on the National Register of Historic Places. Assistance in the preparation of this information may be obtained from state natural resources departments.

(3) A description of the expected environmental impacts resulting from construction and operation of the project. Include a discussion of specific measures proposed by the applicant or others to protect and enhance environmental resources and to mitigate adverse impacts of the project on the environmental resources and values, and the cost thereof.

(4) A description of alternative means of obtaining an amount of electric power equivalent to that provided by the project in the event that construction or continued operation of the project is not authorized.

(5) A description of the steps taken by the Applicant in consulting with Federal, State, and local agencies during the preparation of the environmental report. Indicate which agencies have received the final report and provide copies of letters containing the comments of those agencies.

PART 2—GENERAL POLICY AND INTERPRETATIONS

4. The Commission proposes to amend Part 2, Subchapter A—General Rules, Chapter 1, Title 18, Code of Federal Regulations, by adding two new L-Forms, L-22, and L-23, to the end of § 2.9(c).

As amended, § 2.9(c) will read:

§ 2.9 Conditions in preliminary permits and licenses—list of and citations to "P-" and "L-" Forms.

(c) * * *
P-1: * * *

L-22: Short-Form License, Projects Affecting Lands of the United States, 57 FPC—(April, 1978).

L-23: Short-Form License, Projects Not Affecting Lands of the United States, 57 FPC—(April, 1978).

B. Proposed new L-Forms L-22 and L-23 are attached to this Notice of Proposed Rulemaking as Appendix A and Appendix B respectively.

C. Any interested person may submit to the Federal Energy Regulatory Commission, Washington, D.C. 20426, not later than May 23, 1978, data, views, comments or suggestions in writing concerning all or part of the amendments proposed herein. Written submittals will be placed in the Commission's public files and will be available for public inspection at the Commission's Office of Public Information, 825 North Capitol Street, Washington, D.C. 20426 during regular business hours. The Commission will consider all such written submittals before acting on the matters herein proposed. An original and 14 conformed copies should be filed with the Secretary of the Commission. Submittals to the Commission should indicate the name,

title, and mailing address of the person to whom communications concerning the proposal should be addressed and whether the person filing them requests a conference with the staff of the Commission to discuss the proposed amendments. The staff, in its discretion, may grant or deny requests for conferences.

D. The Secretary shall cause prompt publication of this notice to be made in the FEDERAL REGISTER.

By Direction of the Commission.

KENNETH F. PLUMB,
Secretary.

APPENDIX A

FEDERAL ENERGY REGULATORY COMMISSION
Form L-22 (April, 1978)

SHORT FORM LICENSE

Projects Affecting Lands of the United States

Project No. _____
An application was filed on _____ and supplemented on _____ by _____ for a short form license for a hydroelectric project located on lands of the United States.

Order issuing short form license:

Date of issuance: _____

(A) This license is issued to _____ (Licensee) of _____, for a period effective the first day of the month in which this order is issued, and terminating _____ years thereafter, for the construction and/or operation and maintenance of Project No. _____ located on _____, a tributary of the _____, affecting lands of the United States under the administration of _____, subject to the terms and conditions of the Federal Power Act, insofar as not expressly waived herein, which Act is incorporated by reference as part of this license and subject to such rules and regulations as the Commission has issued or prescribed under the provisions of the Act.

(B) This project consists of:

(i) all lands constituting the project area and enclosed by the project boundary or the Licensee's interests in such lands, the limits of which are otherwise defined, the use and occupancy of which are necessary for the purpose of the project; such project area and project boundary being shown and described by certain Exhibit K drawing(s), FERC No(s). _____, which also form part of the application for license.

(ii) project works consisting of; the location, nature, and character of which are more specifically shown and described by the exhibit hereinbefore cited and by Exhibit L drawing(s), FERC NO(s). _____, which also form part of the application for license.

(iii) all of the structures, fixtures, equipment, or facilities used or useful in the maintenance and operation of the project and located on the project area, and such other property as may be used or useful in connection with the project or any part thereof; together with all riparian or other rights, the use or possession of which are necessary or appropriate in the maintenance or operation of the project.

The exhibits designated and described in the above paragraphs are hereby approved and made a part of the license.

(C) Pursuant to Section 10(i) of the Federal Power Act, it has been found in the public interest to waive the following Sections of Part I of the Act, and they are hereby excluded from the license:

Section 4(b), except the second sentence thereof relating to free access by the Commission or its agents to the project works and project records; 4(e), insofar as it relates to approval of plans by the Chief of Engineers and the Secretary of the Army; 10(c), insofar as it relates to depreciation reserves; 10(d); 10(f); 11; 12; and 14, except insofar as the power of condemnation is reserved; 15; 18, except as it relates to fishways; 19; 20; 21; 22; and 23(a), insofar as it relates to the determination of fair value.

(D) This license is also subject to the following conditions:

Article 1. This entire project shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, and exhibits approved by the Commission, without approval by the Commission. If the Licensee or the Commission deems it necessary or desirable that any approved exhibits be changed, revised exhibits shall be submitted to the Commission covering the proposed changes which, upon approval by the Commission, shall become a part of the license, superseding such exhibit or exhibits previously made a part of the license. Minor changes in project works, or in uses of project lands and waters, or divergence from approved exhibits may be made if such changes will not result in a decrease in efficiency, in an adverse environmental impact, or in impairment of the general scheme of development. Any such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of the aforesaid results, shall be subject to such alteration as the Commission may direct.

Article 3. The construction and/or operation and maintenance of the project and any work incidental thereto, shall be subject to the inspection and supervision of the authorized representative the Commission may designate for such purposes. The Licensee shall cooperate fully with said representative and shall furnish such information as may be required concerning the construction, operation, and maintenance of the project. The Licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties.

Article 4. During the period of the license, Licensee shall retain possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use. None of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without prior written approval of the Commission. The provisions of this article are not intended to prevent the replacement of structures, equipment, or other project works when they become obsolete, inadequate, or inefficient for further service due to wear and tear.

Article 5. The operations of the Licensee shall be subject to such reasonable rules and regulations as the Commission may prescribe from time to time for protection of life, health, and property.

Article 6. The Licensee shall, for the conservation and enhancement of fish and wildlife resources, construct, maintain, and operate, (or arrange therefor), such reasonable facilities and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior, or the fish and wildlife agency of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 7. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of the Licensee's lands and interests in lands and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under the license.

Article 8. In the construction and/or maintenance and operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion, stream sedimentation, and any form of water or air pollution. The Commission may order the Licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 9. Timber on lands of the United States cut, used, or destroyed in the construction and maintenance of the project works, or in the clearing of said lands, shall be paid for, and the resulting slash and debris disposed of, in accordance with the requirements of the agency of the United States having jurisdiction over said lands. Payment for merchantable timber shall be at current stumpage rates, and payment for young growth timber below merchantable size shall be at current damage appraisal values. However, the agency of the United States having jurisdiction may sell or dispose of the merchantable timber to others than the Licensee: *Provided*, That timber so sold or disposed of shall be cut and removed from the area prior to, or without undue interference with operations of the Licensee and in coordination with the Licensee's project construction schedules. Such sale or disposal to others shall not relieve the Licensee of responsibility for the clearing and disposal of all slash and debris from project lands.

Article 10. The Licensee shall do everything reasonably within its power, and shall require its employees, contractors, and employees of contractors to do everything reasonably within their power, both independently and upon the request of officers of the agency concerned, to prevent, make advance preparations for suppression of, and to suppress fires on the lands to be occupied or used under the license. The Licensee shall be liable for and shall pay the costs incurred by the United States in suppressing fires caused from the construction, operation, or maintenance of the project works

or of the works appurtenant or accessory thereto under the license.

Article 11. The Licensee shall interpose no objection to, and shall in no way prevent, the use by the agency of the United States having jurisdiction over the lands of the United States affected, or by persons or corporations occupying lands of the United States under permit, of water for fire suppression from any stream, conduit, or body of water, natural or artificial, used by the Licensee in the operation of the project works covered by the license, or the use by said parties of water for sanitary and domestic purposes from any stream, conduit, or body of water, natural or artificial, used by the Licensee in the operation of the project works covered by the license.

Article 12. The Licensee shall be liable for injury to, or destruction of, any buildings, bridges, roads, trails, lands, or other property of the United States, occasioned by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. Arrangements to meet such liability, either by compensation for such injury or destruction, or by reconstruction or repair of damaged property, or otherwise, shall be made with the appropriate department or agency of the United States.

Article 13. The Licensee shall allow any agency of the United States, without charge, to construct or permit to be constructed on, through, and across those project lands which are lands of the United States, such conduits, chutes, ditches, railroads, roads, trails, telephone and power lines, and other routes or means of transportation and communication as are not inconsistent with the enjoyment of said lands by the Licensee for the purposes of the license. This license shall not be construed as conferring upon the Licensee any right of use, occupancy, or enjoyment of the lands of the United States other than for the construction, operation, and maintenance of the project as stated in the license.

Article 14. In the construction and maintenance of the project, the location and standards of roads and trails on lands of the United States and other uses of lands of the United States, including the location and condition of quarries, borrow pits, and spoil disposal areas, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved.

Article 15. The Licensee shall make provision for or shall bear the reasonable cost, as determined by the agency of the United States affected, of making provision for avoiding inductive interference between any project transmission line or other project facility constructed, operated, or maintained under the license, and any radio installation, telephone line, or other communication facility installed or constructed before or after construction of such project transmission line or other project facility and owned, operated, or used by such agency of the United States in administering the lands under its jurisdiction.

Article 16. The Licensee shall make use of the Commission's guidelines and other recognized guidelines for treatment of transmission line rights-of-way, and shall clear such portions of transmission line rights-of-way across lands of the United States as are designated by the officer of the United States in charge of the lands; shall keep the areas so designated clear of all refuse and inflammable material to the satisfaction of

such officer; shall trim all branches of trees in contact with or likely to contact the transmission lines; shall cut and remove all dead or leaning trees which might fall in contact with the transmission lines; and shall take such precautions against fire as may be required by such officer. No fires shall be set except with the prior written consent as to time and place issued by the Secretary of the United States in charge of the lands.

Article 17. The right of the Licensee and of its successors and assigns to use or occupy waters over which the United States has jurisdiction, or lands of the United States under the license, for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless the Licensee has obtained a new license pursuant to the then existing laws and regulations, or an annual license under the terms and conditions of this license. The Commission, after notice and opportunity for hearing, may require the Licensee to remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over the lands unless otherwise agreed upon in writing or in this license. If the Licensee fails to remove all such structures or improvements within a reasonable period, they shall become the property of the United States, but that will not relieve the Licensee of liability for the cost of their removal and restoration of the site.

Article 18. The Licensee, prior to construction or initiation of power operations, shall contact the officer having administrative jurisdiction of any lands of the United States affected by the project to ascertain the need for obtaining a right-of-way permit for such lands. If a permit is required, a copy shall be furnished the Commission clearly marked with the licensed project number to which the permit relates.

Article 19. If the licensee, within the license term, shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or discontinue good faith operation of the project or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the licensee or its agent, the Commission will deem it to be the intent of the licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the licensee to remove any or all structures, equipment, and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the U.S. agency having jurisdiction over its lands, and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the licensee to surrender the license.

Article 20. The licensee shall continue to consult and cooperate with the Fish and Wildlife Service of the U.S. Department of the Interior, the State Fish and Game Commission, the State Historic Preservation Office, the officer having jurisdiction over the lands, and other appropriate agencies, as necessary to insure the protection and enhancement of the environmental resources and cultural values at the project area.

Article 21. The licensee shall pay the United States the following annual charge, effective as of the first day of the month in which this license is issued:

(i) For the purpose of reimbursing the United States for the cost of administration under part I of the act, a minimum annual charge of \$_____ per annum, or such amount as may be determined from time to time pursuant to the Commission's regulations.

(ii) For the purpose of recompensing the United States for the use, occupancy, and

enjoyment of _____ acres of its lands, an amount as may be determined from time to time pursuant to the Commission's regulations.

Article 22. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

ADDITIONAL SPECIAL ARTICLES

(E) This order shall become final 30 days from the date of its issuance unless an application for rehearing shall be filed as provided in section 313(a) of the Federal Power Act, and failure to file such an application shall constitute acceptance of this license. The acknowledgement of acceptance attached to this license shall be signed for the licensee and returned to the Commission within 60 days from the date of issuance of this order.

FEDERAL ENERGY REGULATORY
COMMISSION

NAME AND TITLE

SIGNATURE

DATE

Secretary

In testimony of (its) acknowledgement of acceptance of all of the terms and conditions of the foregoing order, _____ (Name), this _____ day of _____, 19____, has caused his (its corporate) name to be signed hereto (by _____, its President, and its corporate seal to be affixed hereto and attested by _____, its Secretary, pursuant to a resolution of its Board of Directors duly adopted on the _____ day of _____, 19____, a certified copy of the record of which is attached hereto).

(By _____)

(Attest: _____ Secretary.)

NOTE.—Execute in quadruplicate. Statements within brackets apply only to corporations, municipalities, and associations of citizens.

APPENDIX B.—FEDERAL ENERGY REGULATORY COMMISSION FORM L-23 (APRIL 1978)

SHORT FORM LICENSE (PROJECTS NOT AFFECTING LANDS OF THE UNITED STATES)

Project No. _____

An application was filed on _____ and supplemented on _____ by _____ for a short form license for a hydroelectric project.

ORDER ISSUING SHORT FORM LICENSE

Date of issuance: _____

(A) This license is issued to _____ (licensee) of _____, for a period effective

the first day of the month in which this order is issued, and terminating _____ years thereafter, for the construction and/or operation and maintenance of project No. _____ located on _____, a tributary of the _____, subject to the terms and conditions of the Federal Power Act, insofar as not expressly waived herein, which Act is incorporated by reference as part of this license and subject to such rules and regulations as the Commission has issued or prescribed under the provisions of the Act.

(B) This project consists of:

(i) All lands constituting the project area and enclosed by the project boundary or the licensee's interests in such lands, the limits of which are otherwise defined, the use and occupancy of which are necessary for the purpose of the project; such project area and project boundary being shown and described by certain exhibit K drawing(s), FERC No(s). _____, which also form part of the application for license.

(ii) Project works consisting of: _____, the location, nature, and character of which are more specifically shown and described by the exhibit hereinbefore cited and by exhibit L drawing(s), FERC No(s). _____, which also form part of the application for license.

(iii) All of the structures, fixtures, equipment, or facilities used or useful in the maintenance and operation of the project and located on the project area, and such other property as may be used or useful in connection with the project or any part thereof; together with all riparian or other rights, the use or possession of which are necessary or appropriate in the maintenance or operation of the project.

The exhibits designated and described in the above paragraphs are hereby approved and made a part of the license.

(C) Pursuant to section 10(i) of the Federal Power Act, it has been found in the public interest to waive the following sections of part I of the Act, and they are hereby excluded from the license:

Section 4(b), except the second sentence thereof relating to free access by the Commission or its agents to the project works and project records; 4(e), insofar as it relates to approval of plans by the Chief of Engineers and the Secretary of the Army; 10(c), insofar as it relates to depreciation reserves; 10(d); 10(f); 11; 12; and 14, except insofar as the power of condemnation is reserved; 15; 16; 18, except as it relates to fishways; 19; 20; 21; 22; and 23(a), insofar as it relates to the determination of fair value.

(D) This license is also subject to the following conditions:

Article 1. The entire project shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, and exhibits approved by the Commission, without approval by the Commission. If the licensee or the Commission deems it necessary or desirable that any approved exhibits be changed, revised exhibits shall be submitted to the Commission covering the proposed changes which, upon approval by the Commission, shall become a part of the license, superseding such exhibit or exhibits previously made a part of the license. Minor changes in project works, or in uses of project lands and waters, or divergence from approved exhibits may be made if such changes will not result in a decrease in efficiency, in an adverse environmental impact, or in impairment of the general scheme of development. Any such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of the aforesaid results, shall be subject to such alteration as the Commission may direct.

Article 3. The construction and/or operation and maintenance of the project, and any work incidental thereto, shall be subject to the inspection and supervision of the authorized representative of the Commission may designate for such purposes. The licensee shall cooperate fully with said representative and shall furnish such information as may be required concerning the construction, operation, and maintenance of the project. The licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties.

Article 4. During the period of the license, licensee shall retain possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use. None of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without prior written approval of the Commission. The provisions of this article are not intended to prevent the replacement of structures, equipment, or other project works when they become obsolete, inad-

equated, or inefficient for further service due to wear and tear.

Article 5. The operations of the licensee shall be subject to such reasonable rules and regulations as the Commission may prescribe from time to time for protection of life, health, and property.

Article 6. The licensee shall, for the conservation and enhancement of fish and wildlife resources, construct, maintain, and operate (or arrange therefor), such reasonable facilities and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior, or the fish and wildlife agency of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 7. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities at its own expense, the licensee shall permit the United States or its designated agency to use, free of cost, such of the licensee's lands and interests in lands and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the licensee of any obligation under the license.

Article 8. In the construction and/or maintenance and operation of the project, the licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion, stream sedimentation, and any form of water or air pollution. The Commission may order the licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 9. The licensee shall make provision for, or shall bear the reasonable cost of making provision for, avoiding inductive interference between any project transmission line or other project facility constructed, operated, or maintained under the license; and any radio installation, telephone line, or other communication facility installed or constructed before or after construction of such project transmission line or other project facility.

Article 10. The licensee shall make use of the Commission's guidelines and other recognized guidelines for treatment of transmission line rights-of-way, shall clear such transmission line rights-of-way and shall keep such areas clear of all refuse and inflammable material; shall trim all branches of trees in contact with or likely to contact

the transmission lines; shall cut and remove all dead or leaning trees which might fall in contact with the transmission lines; and shall take precautions against fire.

Article 11. If the licensee, within the license term, shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or continue good faith operation of the project, or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the licensee or its agent, the Commission will deem it to be the intent of the licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the licensee to remove any or all structures, equipment, and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the authorized representative of the Commission, and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the licensee to surrender the license.

Article 12. The licensee shall continue to consult and cooperate with the Fish and Wildlife Service of the U.S. Department of the Interior, the State Fish and Game Commission, the State Historic Preservation Office, and other appropriate agencies, as necessary to insure the protection and enhancement of the environmental resources and cultural values at the project area.

Article 13. The licensee shall pay the United States the following annual charge, effective as of the first day of the month in which this license is issued:

(1) For the purpose of reimbursing the United States for the cost of administration under part I of the act, a minimum annual charge of \$— per annum, or an amount as may be determined from time to time pursuant to the Commission's regulations.

Article 14. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

ADDITIONAL SPECIAL ARTICLES

(E) This order shall become final 30 days from the date of its issuance unless an application for rehearing shall be filed as provided in section 313(a) of the Federal Power Act, and failure to file such an application shall constitute acceptance of this license. The acknowledgement of acceptance attached to this license shall be signed for the licensee and returned to the Commission within 60 days from the date of issuance of this order.

FEDERAL ENERGY REGULATORY
COMMISSION

NAME AND TITLE

SIGNATURE

DATE

SECRETARY

APPENDIX H

INSURANCE COMPANY RESPONSES

RECEIVED
L.M.M.Sr.
MAR 22 1977

NEW HAMPSHIRE
WATER RESOURCES BOARD

March 21, 1977

THE ROWLEY AGENCY, Inc.

Mr. George M. McGee, Sr., Chairman
Governors Hydro Electric Energy Commission
c/o Water Resources Board
Pleasant Street
Concord, N.H. 03301

Re: Liability Insurance Report

Dear Mr. McGee:

This is my contribution to the commission's final report, relative to the acquisition of high limit liability insurance protection on reactivated former hydro sites.

My agency, on behalf of the commission, sent inquiries to approximately fifteen insurance company markets, asking for a statement of their position with regard to Dam liability. We also specifically referred to the five sites under consideration as representative of the reactivation possibilities.

With one exception, all responses were negative. (examples of replies attached) The Hartford Insurance Group did offer a positive reply in this sense: Their position is very conservative (maximum limit 300/300 and 100/100 before reinsurance) and their underwriting approach the same, involving much time and expense which of course, would be reflected in their final pricing. (See copy of reply attached)

My conclusion is that the acquisition of high limit liability insurance protection for such hydro-sites, would, at best, be a very long and exhausting procedure, and would involve significant premium expenses if the owner-operator were successful in attracting the interest of the (apparently very few) company markets who offer this kind of coverage.

Respectfully submitted,

THE ROWLEY AGENCY, INC.

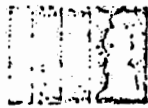
By: 

William J. Wiley, CPCU

Insurance by Professionals

WJW/pa

P.O. Box 511, 139 Loudon Road, Concord, New Hampshire 03301 Telephone (603) 224-2562



THE MINUTE MAN COMPANIES

MIDDLESEX INSURANCE COMPANY

PATRIOT GENERAL INSURANCE COMPANY

CONCORD, MASSACHUSETTS • 01742

February 11, 1977

Rowley Agency, Inc. 2216
P.O. Box 511
Concord, New Hampshire 03301

RECEIVED
FEB 14 1977
THE ROWLEY
AGENCY, INC.

Reference: Public Liability Coverage on
Dams in the State of New Hampshire

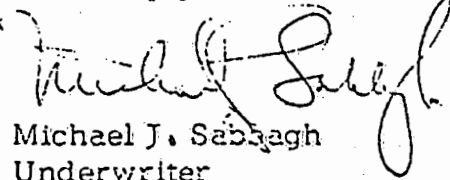
Dear Bill:

Upon receipt of your request on our position concerning the above, the following is our decision.

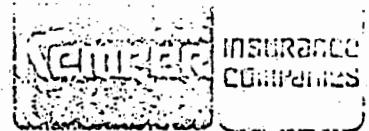
This is a class of business of which we are not interested in writing. Therefore, as far as the Middlesex is concerned, we consider no coverage and will not consider coverages on dams for public liability. I appreciate your sending me this, but as stated above as a company we are not interested in this type of business.

I hope we can be of some help in the future.

Sincerely yours,


Michael J. Sabaggh
Underwriter

lj



150 Newport Avenue
North Quincy, MA 02171

617 | 328-2000

REC'D
FEB 17 1977
THE ROWLEY
AGENCY, INC.

February 14, 1977

Mr. William J. Wiley
Rowley Agency, Inc.
Concord, New Hampshire

Dear Mr. Wiley:

PUBLIC LIABILITY COVERAGE ON DAMS

Thank you very much for your inquiry as to our underwriting guide lines on dams in the state of New Hampshire.

However, we are not a market for this type of General Liability Coverage. Therefore, I cannot give you any underwriting requirements or a pricing approach that we would use.

Very truly yours,

LUMBERMENS MUTUAL CASUALTY COMPANY

Linda

Linda Clayworth
Commercial Casualty Underwriting

122



RECEIVED
FEB 18 1977
THE ROWLEY
AGENCY, INC.

February 16, 1977

The Rowley Agency, Inc.
P. O. Box 511
Concord, N. H. 03301

Attention - William J. Wiley CPCU

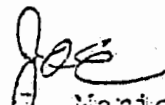
Re: Public Liability Coverage
On Dams

Dear Bill:

This will acknowledge receipt of your letter of February 8, 1977. The New Hampshire Insurance Company would not be interested in providing public liability coverage on Dams either on an existence hazard only basis or on the operation.

Thank you.

Very truly yours,


N. J. Mario
Underwriting Manager

NJM/imc

cc: Don Lefebvre, Spec. Agent

Manchester Regional Office
1528 Elm Street
P. O. Box 809
Manchester, New Hampshire 03105
Telephone: (603) 623-8045

Report on
H-E energy in N.H.



THE HARTFORD

February 14, 1977

Mr. William Wiley
The Rowley Agency, Inc.
139 Loudon Road
Concord, New Hampshire 03301

RECEIVED
FEB 15 1977
THE ROWLEY
AGENCY, INC.

Re: Public Liability Coverage on Dams

Dear Bill:

In response to your letter of February 8th on the captioned, I can offer the following comments:

It is very difficult at this point to give you "ball park" estimates of the cost of General Liability coverage for the State dams that you mentioned. We believe that we would also have to consider who is going to be operating the power plants from these dams. The information given indicates that it could be the State or private interests depending on each individual site. We must also have full Loss Control information developed from not only the engineering data on file in the Office of Water Resources but data developed from inspection of the various locations. We would also have to develop information on all exposures in each surrounding area plus we would have to review and/or develop topography and geological information on each area. This information would have to be developed with some of our Loss Control experts in the Home Office along with outside consultants. The development of this information would involve a great deal of time and expense which would be reflected in any price consideration.

Our underwriting of these exposures is very conservative and we proceed only after a full evaluation of all the exposures indicated. We generally retain limits of liability no greater than \$300/300,000 BI and \$100/100,000 PD. The balance of the limits are reinsured. We, of course, would be guided accordingly by the reinsurance markets which, at this point in time, is very tight.

Our pricing, generally, is arrived at by considering, after company expense, what is needed to cover a maximum probable loss on a long term basis. This

-continued-

C-NH-14

Hartford Fire Insurance Company
Hartford Accident and Indemnity Company
Hartford Life Insurance Company
Hartford Casualty Insurance Company
New York Underwriters Insurance Company

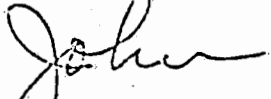
Mr. William Wiley
Page -2-
February 14, 1977

term may run from five to fifteen years based on the information developed, the probability of natural disasters such as floods or earthquakes and any other pertinent considerations we feel would be valuable.

After all of this, any premiums developed would probably be considered to be very expensive.

I hope this gives you some idea of the problems involved in the underwriting of this class of business.

Very truly yours,



John J. Alachnowicz
Casualty Manager

clf